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TOMATO-SEEDLING DAMPING-OFF.

CONTROL BY SEED DUSTING.

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IN a previous paper (Brien and Chamberlain, 1936) on the control of tomato-seedling damping-off, it was pointed out that the organisms responsible were soil fungi, and that control of the disease could be secured only by soil treatments.

If a suitable therapeutant is applied to the surface of the seed before sowing, the soil in its immediate vicinity is disinfected, and protection is given to the young seedlings during the period they are susceptible to attack. Therapeutants are most conveniently applied to the seed in the form of dusts. Experiments described herein were undertaken to test the efficiency of this method and to determine which dusts gave the best control.

REVIEW OF LITERATURE.

Experiments carried out by Godbout (1930) with "Bayer dip dust," "Semesan," and nickel sulphide as seed dusts, showed that "Bayer dip dust" and "Semesan" gave satisfactory control of damping-off (*Pythium de Baryanum*), on muskmelon, cucumber, radish, cabbage, and brussels sprouts. Horsfall (1932A) in a series of experiments on the control of tomato-seedling damping-off (*Pythium ultimum*) used red copper oxide, copper carbonate, and copper sulphate. He found that red copper oxide was more effective than copper carbonate for both pre- and post-emergent phases of the disease, but was less satisfactory than copper-sulphate dust for the pre-emergent phase. The same writer (Horsfall, 1932B) showed that monohydrated copper sulphate was more effective than copper carbonate in protecting tomato-seedlings against both phases of damping-off. Anhydrous copper sulphate was shown to be equally efficient, but Horsfall did not recommend it for general practice because of its high cost.

Experimental Method.

The experiments were carried out in the glasshouse using a soil-mixture of clay loam and silt in seed-boxes 18 in. by 12 in. by 3 in. Seven to ten days prior to sowing, the soil, either untreated or steam-disinfected, was inoculated with cultures of *Pythium ultimum* grown on potato dextrose agar.

Seed was shaken with the dust for five minutes in a glass vessel, the excess being then screened off. The seed was sown at the rate of either $\frac{1}{14}$ oz. or 500 seeds per box. Following the appearance of damping-off, counts of infected plants were taken daily. Final counts of the healthy plants left in the boxes were taken four to five weeks after sowing, by which time they had advanced beyond the damping-off stage.

The following dust materials were tested :—

(1) "*Ceresan U.T. 1875.*"—This proprietary organic mercury dust contains, as its active constituent, mercury-phenyl-acetate.

(2) "*Agrosan G.*"—Another proprietary organic mercury dust, of which the active constituent is mercury-tolyl-acetate.

(3) *Monohydrated Copper Sulphate.*—A dust prepared by heating crystalline copper sulphate at 105° C. The crystals break down to a fine pale blue powder. It is unstable when exposed to air, and must therefore be stored in an airtight glass or earthenware container.

(4) *Copper Carbonate.*—For the purpose was used a high-grade basic copper carbonate having a copper content of 50 per cent. to 54 per cent., and a particle size less than 10 microns.

(5) *Red Copper Oxide (Cuprous Oxide).*—This is not a standardized material, the commercial article being of variable purity. It is unstable in the presence of air.

(6) *Copper Oxychloride.*—A proprietary product marketed under the name of "Smutol" was used. It has a copper content of 54 per cent., and particles averaging 5 microns in diameter.

(7) "*R.D. 7312.*"—An organic mercury dust the active constituent of which is ethyl-mercury-phosphate. This dust is still in the experimental stage, and has not been placed on the market.

"Ceresan," "Agrosan G.," copper carbonate, and copper oxychloride are all available in New Zealand.

Experiment I.

"Ceresan," monohydrated copper sulphate, red copper oxide, copper carbonate, and copper oxychloride were used. The soil was inoculated on 13th August, 1935, and on the 5th September was sown with

Sutton's Best of All tomato-seed at the rate of $\frac{1}{14}$ oz. per box. The seed gave a germination test of 99 per cent. in ten days. Results are given in Table I :—

Table I.—Results of Experiment I : Seed sown in Untreated Soil inoculated with Pythium ultimum.

Seed Dust employed.	Number of Plants emerged.	Percentage of Plants damped-off.		Average Percentage of Plants damped-off.	Remarks on Germination.
		Pre-emergent.	Post-emergent.		
Untreated seed ..	Box A = 258	44	28	76	..
	Box B = 198	58	22		
Monohydrated copper sulphate	Box A = 440	6	9	20	..
	Box B = 402	14	11		
" Ceresan " ..	Box A = 454	3	13	21	Slight delay.
	Box B = 449	4	9		
Copper carbonate ..	Box A = 463	1	12	23	Slight delay.
	Box B = 408	12	20		
Copper oxychloride	Box A = 407	13	15	24	..
	Box B = 441	5	15		
Red copper oxide ..	Box A = 405	13	9	18	..
	Box B = 428	8	5		
*Steam-disinfected soil	Box A = 469	0	0	0	Slight delay.
	Box B = 463	0	0		

* Untreated seed was sown in steam-disinfected soil, the average germination per box being taken as representing complete germination and used as a basis on which to calculate the percentage of damping-off occurring in the seed-dust treatments. The same method of calculation was used in Experiments II, III, and IV.

Experiments II, III, and IV.

In these were used the seed dusts " Ceresan," " Agrosan G.," copper carbonate, and " R.D. 7312." The soil was inoculated on the 6th July, 1936, and sown on the 29th July with Sutton's Best of All tomato-seed, which gave a laboratory germination test of 99 per cent. in ten days. The seed was sown at the rate of 500 per box.

In experiment II seed was sown in steam-disinfected soil which had been subsequently inoculated with the damping-off fungus. Soil used in experiment III was untreated and inoculated with *P. ultimum.* Soil for experiment IV was untreated and uninoculated. Results are given in Tables II, III, and IV :—

Table II.—Results of Experiment II : Seed sown in Steam-disinfected Soil inoculated with Pythium ultimum.

Seed Dust employed.	Number of Plants emerged.	Percentage of Plants damped-off.		Average Percentage of Plants damped-off.	Remarks on Germination.
		Pre-emergent.	Post-emergent.		
Untreated seed ..	Box A = 83	83	11	94	..
	Box B = 64	87	7		
" Ceresan " ..	Box A = 318	36	14	51	..
	Box B = 326	34	17		
Copper carbonate ..	Box A = 413	17	25	39	Slight delay.
	Box B = 442	11	24		
" R.D. 7312 " ..	Box A = 385	22	8	31	Much delay.
	Box B = 367	26	6		
Steam - disinfected soil not inoculated	Box A = 500	0	0	0	..
	Box B = 492	0	0		

Table III.—Results of Experiment III : Seed sown in Untreated Soil inoculated with Pythium ultimum.

Seed Dust employed.	Number of Plants emerged.	Percentage of Plants damped-off.		Average Percentage of Plants damped-off.	Remarks on Germination.
		Pre-emergent.	Post-emergent.		
Untreated seed ..	Box A = 185	63	15	67	..
	Box B = 300	40	16		
" Ceresan " ..	Box A = 481	3	3	5	..
	Box B = 485	2	2		
" Agrosan G." ..	Box A = 394	21	3	18	..
	Box B = 451	9	3		
Copper carbonate ..	Box A = 480	3	10	16	..
	Box B = 453	9	9		
" R.D. 7312 " ..	Box A = 450	9	3	11	Delayed.
	Box B = 458	8	2		
Steam - disinfected soil not inoculated	Box A = 500	0	0	0	..
	Box B = 492	0	0		

Table IV.—Results of Experiment IV : Seed sown in Farm Soil naturally infected with Pythium ultimum.

Seed Dust employed.	Number of Plants emerged.	Percentage of Plants damped-off.		Average Percentage of Plants damped-off.	Remarks on Germination.
		Pre-emergent.	Post-emergent.		
Untreated seed ..	Box A = 337	32	18	39	..
	Box B = 423	15	13		
" Ceresan " ..	Box A = 487	2	7	10	..
	Box B = 466	6	4		
Copper carbonate ..	Box A = 464	6	4	13	..
	Box B = 472	5	10		
" R.D. 7312 " ..	Box A = 462	7	1	7	Delayed.
	Box B = 477	4	2		
Steam - disinfected soil not inoculated	Box A = 500	0	0	0	..
	Box B = 492	0	0		

Experiment V.

" Ceresan," " Agrosan G.," copper carbonate, and " R.D. 7312 " were again used. Untreated soil was inoculated on the 8th September, 1936, with *P. ultimum*, and the tomato-seed sown on the 29th September, at the rate of 500 per box. The seed was of the same variety as used in the other experiments. Results are given in Table V :—

Table V.—Results of Experiment V: Seed sown in Untreated Soil inoculated with Pythium ultimum.

Seed Dust employed.	Number of Plants emerged.	Percentage of Plants damped-off.		*Average Percentage of Plants damped-off.	Remarks on Germination.
		Pre-emergent.	Post-emergent.		
Untreated seed ..	Box A = 236	53	14	69	..
	Box B = 205	59	12		
" Ceresan " ..	Box A = 483	4	1	5	..
	Box B = 476	4	1		
" Agrosan G." ..	Box A = 463	7	2	14	..
	Box B = 434	13	5		
Copper carbonate ..	Box A = 455	9	3	11	..
	Box B = 462	8	2		
" R.D. 7312 " ..	Box A = 430	14	2	14	Much delayed.
	Box B = 450	10	1		

* The percentage damping-off was calculated on the assumption that the seed was capable of giving 100 per cent. germination.

Discussion of Results.

All dusts tested gave seedlings a decided protection against damping-off caused by *P. ultimum*, but none gave complete control. Damping-off was more difficult to control in soil which had been steam-disinfected before being inoculated with the damping-off fungus. Results reported in our previous paper showed that this applied also with soil treatments. The results of experiment IV showed that the farm soil used for these experiments was naturally infected with *P. ultimum* and illustrates the wide distribution of the fungus.

(1) *" Ceresan U.T. 1875."*—Although it failed to give good control in steam-disinfected soil inoculated with *P. ultimum*, this dust gave consistently good results in the other four experiments (see Figs. 1 and 2). It caused slight delay in germination in one experiment.

(2) *" Agrosan G."*—This dust gave fairly good results in the two tests made. It was less efficacious than " Ceresan " or copper carbonate. No delay in germination resulted from its use.

(3) *Monohydrated Copper Sulphate.*—Promising results were secured in the one test made. It controlled damping-off slightly better than did either " Ceresan " or copper carbonate, and caused no delay in germination.

(4) *Copper Carbonate.*—Consistent results were secured in all tests (Fig. 2). In one experiment it gave better control than " Ceresan," but in the other four it proved slightly less efficacious. Slight delay in germination occurred in two of the experiments.

(5) *Red Copper Oxide.*—In the one test it gave promising results, being slightly more efficacious than " Ceresan," copper carbonate, or monohydrated copper sulphate (see Fig. 1).

(6) *Copper Oxychloride* in the one test proved slightly less efficient than " Ceresan," copper carbonate, monohydrated copper sulphate, or red copper oxide.

(7) *" R.D. 7312."*—In the three experiments this dust gave consistently good control of damping-off, but caused severe injury to the seedlings (see Fig. 3).

Recommendations.

None of the dust materials gave complete control of damping-off. Sufficiently good results were obtained, however, to warrant their use by growers who have not the facilities for treating their soil. Organic mercury dusts such as " Ceresan " or " Agrosan G.," or high-grade copper

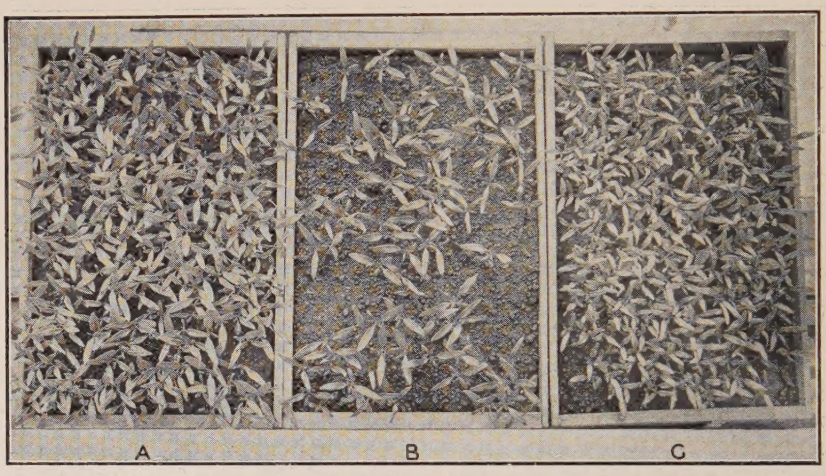

FIG. 1. EFFECT OF SEED DUSTS ON TOMATO-SEEDLING DAMPING-OFF.

All three boxes contained untreated soil to which cultures of *Pythium ultimum* had been added: A, seed dusted with " Ceresan "; B, untreated seed; C, seed dusted with red copper oxide.

[*Photo by H. Drake.*

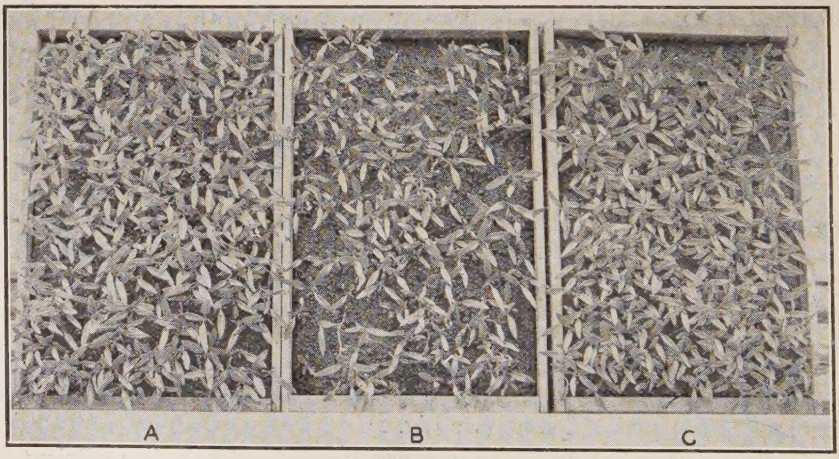

FIG. 2. EFFECT OF SEED DUSTS ON TOMATO-SEEDLING DAMPING-OFF.

Box A contained untreated soil inoculated with *Pythium ultimum*, while boxes B and C contained farm soil naturally infected with this fungus: A, seed dusted with " Ceresan "; B, untreated seed; C, seed dusted with copper carbonate.

[*Photo by H. Drake.*

carbonate are recommended under such conditions. They do not take the place of soil treatments, so that, where practicable, growers are recommended to disinfect seed-box soils by the practices outlined in our previous paper.

Summary.

(1) Results are given of experiments with various seed dusts for the control of tomato-seedling damping-off (*Pythium ultimum*).

(2) Damping-off was more severe and more difficult to control in soil which had been steam-disinfected prior to the addition of cultures of *P. ultimum*.

FIG. 3. SEEDLING INJURY CAUSED BY SEED DUST.

Two seedlings on left grown from seed dusted with copper carbonate. Seedlings on right showing injury resulting from use of an experimental dust "R.D. 7312."

[*Photo by H. Drake.*

(3) None of the dusts tested completely eliminated the disease. Several, however, gave a high percentage of control.

(4) It is suggested that growers who have not the facilities for soil disinfection, may combat damping-off by using such seed dusts as "Ceresan," "Agrosan G.," or copper carbonate.

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GRASSING OF CONSOLIDATED SAND AREAS, NORTHERN WAIROA, NORTH AUCKLAND.

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FARMERS are always interested in virgin land that can be quickly and cheaply converted into good pasture-land, and the consolidated sand areas of the Northern Wairoa offer considerable scope for development in this direction. The extensive grassing-work carried out in the development of this land for settlement under the Small Farms Act has shown that good permanent pastures can be quickly established on this land, provided the soil is carefully cultivated, permanent species of grasses and clovers are sown, and the pastures adequately manured with superphosphate.

Mr. N. H. Taylor, of the Soil Survey Division of the Department of Scientific and Industrial Research, who, at my request, made a brief examination of the area, supplied the soil map and wrote the following sections dealing with topography and soils.

LOCATION AND CLIMATE.

The district referred to in this article as the sand country of the Northern Wairoa is a strip of land fifty miles long and approximately five miles wide, extending from Mangonui Bluff to Kaipara North Head, and lying between the Kaihu and Wairoa Rivers on the east and the sea on the west.

The mean annual rainfall for the district is 50 in., with 150 rainy days per annum(1). The mean monthly temperatures vary from about 63° F. in January and February to 50° F. in August(2). The area is swept by the prevailing westerly winds.

TOPOGRAPHY.

The greater part of the district (a strip along the western side two to three miles wide) is an area of flat-topped spurs and steep-sided valleys, the floors of which are occupied by peaty swamps. In the north the flat-topped spurs reach heights of 400 ft. and 500 ft., but farther south few rise more than 300 ft. above sea-level. West of Mamaranui, where the streams are closely spaced, the bleak, scrub-covered spur-tops and steep valley-sides, scarred with white slips, present a most dismal appearance, but west of Dargaville, where the land is lower, broad flattish spur-tops are the most conspicuous features of the landscape.

The whole of this area is underlain by consolidated water-sorted sands, interbedded with which are small lenses of lignite. On the west the water-sorted sands are buried by drifts of wind-blown sand, but they appear again in an almost unbroken line of cliffs bordering the shore.

The blown-sand country of the west is of three types: (1) The older fixed dunes; (2) the younger fixed dunes; and (3) the bare sand-drifts.

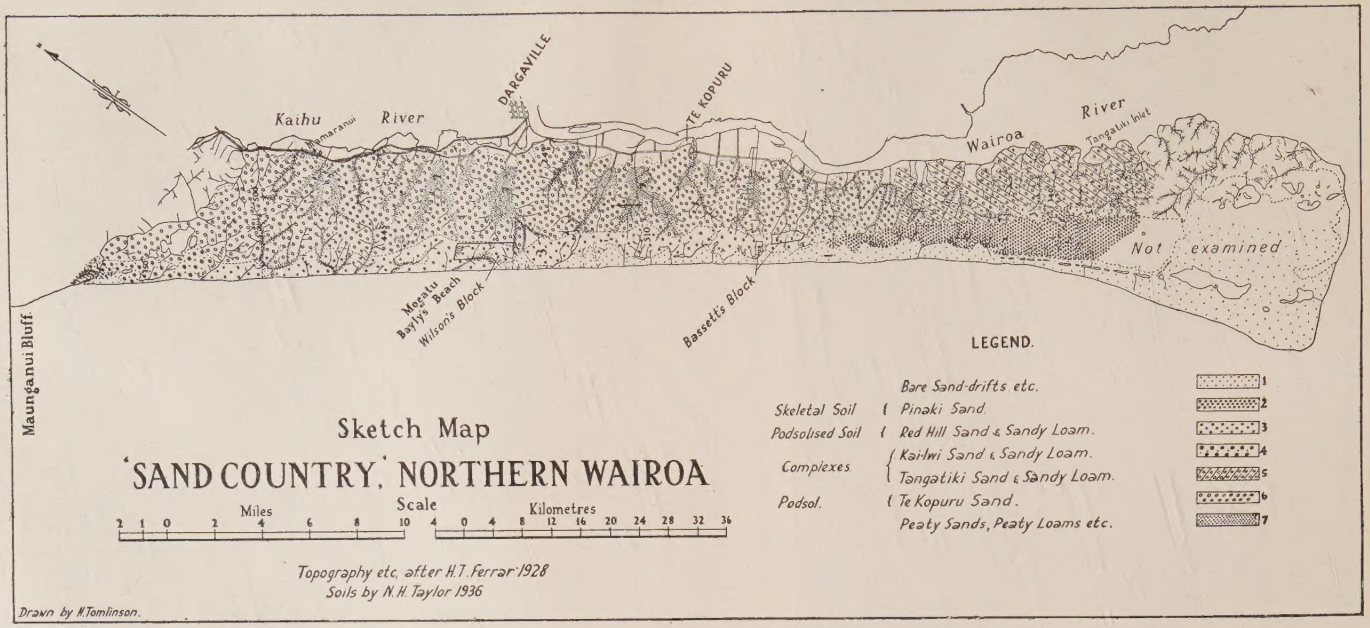

FIG. I. SOIL MAP OF SAND COUNTRY, NORTHERN WAIROA.

The older fixed dunes form a belt of rolling country about a mile wide extending from Kai Iwi Stream to the Tikinui coast road, a distance of about twenty-eight miles. The hills are smoothly rounded and the sand is permanently fixed by weathering.

The younger fixed dunes cover a wedge-shaped strip thirty miles long, lying south of the older fixed dunes. The country, though described as rolling, is more broken than the area covered by the older fixed dunes, for the hills still have the typical dune shape with irregular crest lines and steep lee slopes. The sand is fixed by vegetation, but weathering has not yet fixed the dunes permanently.

The bare sand-drifts (Fig. 2) cover about thirty square miles of the country close to Kaipara North Head, and northwards they taper to a strip flanking the shore, rarely more than half a mile wide. Sand thrown upon the shore by waves is carried inland by the wind, where it accumulates as dunes, which move steadily forward. While they are growing the dunes have a regular shape (steep lee slopes and gentler slopes to windward), but farther inland, where the supply of wind is less regular, the dunes become fixed in places by sand-binding plants and are scoured by the wind into forms resembling miniature mountain ranges. Both the bare drifts and the younger fixed dunes lie athwart the drainage of the older country and dam back the streams to form lakes and ponds (Fig. 3).

Soils.

As the soils throughout the area are somewhat similar in composition and the climate fairly uniform, the main factors leading to soil differentiation are—(1) The covering of vegetation; (2) the topography; (3) the time that has elapsed since the various sand deposits were laid down.

Under a humid climate the rock material decomposes and the soils which form tend to become leached. The vegetation gathers mineral substances from the soil and these are returned to the surface as the leaves die and fall. The vegetation, in this way, tends to work against the rainfall. Topography is important, for on steep slopes the soil tends to be eroded as fast as it is formed. The area is one which has been subjected to many scrub fires, and on this account much of the soil has been eroded. Washing by rain and slipping have removed much of the soil from the steep slopes, and in many exposed localities the unprotected soil has been so completely removed by the wind that the bare sandstone appears at the surface. Fires and over-grazing with stock, by destroying the sand-fixing vegetation, are also assisting the advance of the drifting sand.

The sand soils of the area have been mapped and are shown (Fig. 1) as belonging to five groups: (1) The Pinaki sand, which is classified as a skeletal soil—that is, a very young soil showing little alteration by soil-forming processes; (2) the Red Hill soils, classifed as podsolized soils, or soils which show a well-defined topsoil and subsoil, but have not yet reached the stage of development attained by group 3; (3) the Te Kopuru sand, classified as a podsol* on

*A podsol is a soil in which iron and alumina from the topsoil have been leached to lower horizons, leaving a bleached layer above.

FIG. 2. BARE SAND-DRIFT INVADING THE ROLLING COUNTRY OF THE OLDER FIXED DUNES.

The foreground, the typical vegetation supported by the sand.

FIG. 3. POND FORMED BY THE YOUNG SAND-DUNES DAMMING BACK THE DRAINAGE OF THE OLDER FIXED DUNES.

maturely developed soil; (4) the Tangatiki; and (5) the Kai Iwi soils, classified as complexes or areas covered by a patchwork of soils resembling those of groups 2 and 3.

The Pinaki sand is a young soil, derived from the sand of the younger fixed dunes. It consists of 3 in. to 6 in. of black sand resting on a brown free sandy subsoil. The soil is overdrained, and pastures on it are subject to drought in dry spells.

The Red Hill soils are those covering the older fixed dunes. The Red Hill sandy loam is a light-brown, moderately compact soil resting on lightly cemented sands. Over the western part of the area there is a shallow covering of more recent sand, and soils affected by this covering have been grouped together as the Red Hill sand. A typical profile shows 4 in. to 10 in. of dark-grey sand resting on the moderately compact brown sandy loam. In places the subsoil is darker brown, more clayey in texture, and presents the appearance of a weathered volcanic ash. This is probably due to the fact that at certain periods much of the drift sand has consisted of pumice particles which have been brought from the mouth of the Waikato River by ocean currents and cast ashore by the waves.

The Te Kopuru sand is a soil derived from the older water-sorted sands. The soil is a mature podsol developed under a former kauri forest. A typical profile (Fig. 4) shows 5 in. of grey sand, 5 in. of whitish sand, and 6 in. of a blackish humus pan on cemented sandstone, with iron and alumina pans at different depths. The acid humus collected under the kauri forest, leached throughout the soil, carrying with it the iron and alumina and forming pans below. This soil is badly drained in winter, and, on account of the sandy texture of the topsoil, is dry during the summer. This mature profile is best developed on the flattish spur-tops and easier slopes. Where the slopes are steeper, slumping takes place, and the soils are not so mature.

The Tangatiki soils are complex soils developed on the southern part of the older water-sorted sands. On this area the kauri forest did not form such a continuous cover, and the soil pattern is a patchwork of mature soils resembling the Te Kopuru sand and brown moderately compact sandy loams, somewhat resembling the Red Hill sandy loam. On account of the steepness of much of the country, and because of the continual scrub fires, much of the soil has been eroded and in these places the sandstone is at, or near, the surface.

The Kai Iwi soils are complex soils developed on the older fixed dunes, north of the Kai Iwi Stream. This area has in the past been partly covered with kauri forest. The soil pattern is a patchwork of Te Kopuru sand and Red Hill sandy loam.

Surface Covering.

The natural surface covering of the hill areas (Fig. 5), considerably modified from its primitive state, consists of light manuka scrub and bracken fern, with a sparse growth of danthonia and bay grass (*Eragrostis Brownii*). On the podsolized soils where drainage is bad, rushes and sedges cover considerable areas, while on the swamp areas flax is found growing in addition to strong rushes.

The following indigenous plants are found through the scrub and fern: *Lycopodium densum*, *Cladium teretifolium*, *Lepidosperma laterale*, *Halorrhagis procumbens*, *Microtis unifolia*, *Pimelea prostrata*, *Leucopogon Fraseri*, *Pomaderris phylicaefolia*, and *P. Edgerleyi*. Of introduced plants *Hakea pubescens* and *Erica stricta* occupy much ground, while pines are numerous, and *Ornithopus ebracteatus* and *Gnaphalium purpureum* are frequently met with.

FIG. 4. PROFILE OF THE TE KOPURU SAND, WITH TYPICAL VEGETATION ABOVE.

Note the bleached layer resting on the dark humus pan 10in. to 15in. below the surface. The dark lines below the humus pan are iron pans. The unaltered sandstone appears in the bottom of the picture.

Trouble is being experienced with moving sand encroaching on certain areas (Fig. 2), especially those exposed and adjacent to the sea-coast. Sand is being continually blown and swept from the beaches over the steep coastal cliffs on to the useful consolidated areas by strong westerly winds. Very successful work has been done to check and overcome this continual sand movement. Marram-grass (Fig. 6) has been found an extremely valuable plant for arresting sand movement and large areas are being planted each year with great success.

FIG. 5. ROLLING, RED HILL SANDY LOAM IN NATURAL STATE.

FIG. 6. MARRAM-GRASS, THREE YEARS AFTER PLANTING, RAPIDLY COVERING A SAND-DRIFT AND CHECKING FURTHER ENCROACHMENT.

Fertilizers.

The consolidated sand areas vary in fertility according to type, but are all deficient in phosphate and nitrogen. Poor pasture-swards (Fig. 7), consisting of stunted paspalum, *Lotus hispidus*, brown-top, sweet vernal, tar-weed, and danthonia, cover a large area of the Te Kopuru soil type. These poor pastures respond quickly to phosphatic top-dressing (especially basic slag), while applications of lime also give improved responses when used in addition. The fertility of this soil is extremely low, while the drainage is poor, and even with heavy applications of phosphatic fertilizers and lime it is practically impossible to establish and maintain a high-producing pasture. Top-dressing will, however, improve the existing sward, but it is doubtful if it is a payable procedure.

On the other hand, the Red Hill sandy-loam soil type has good drainage and higher fertility, which makes pasture establishment on this soil type an easier proposition. Considerable areas of this soil type have in past years been burned and surface sown. The resultant pasture-sward (Fig. 8) has been neglected, and the sward now consists of ratstail, danthonia, suckling clover, catsear, and in places paspalum—a very poor unpayable type of sward, for on this land a first-class pasture consisting of perennial rye-grass, white clover, cocksfoot, and paspalum can be established and maintained provided the necessary precautions regarding good cultivation, sowing good strains of permanent grasses, and using adequate supplies of phosphate are taken.

Fertilizer experimental work in pasture top-dressing carried out on these soils has given the following results :—

Experiment No.	Soil.	Responses to Fertilizers: 0, no response; 1, slight; 2, fair; 3, good; 4, very good; 5, excellent.						
		Superphosphate.	Lime.	Potash.	Superphosphate plus Lime.	Superphosphate plus Lime plus Potash.	Slag.	Slag plus Lime.
16/1/226 ..	Red Hill sand..	4	1	0	4⅓	4½	..	..
16/1/227 ..	Red Hill sand..	3	0	0	3½	3½	..	..
16/1/228 ..	Red Hill sand..	4	1	0	5	5	..	..
16/1/229 ..	Red Hill sand..	4	0	0	4	4	..	..
16/1/98 (D)	Te Kopuru sand	2	1	0	3	3	3	4

Experiments 16/1/226, 227, 228, and 229 were laid down during the autumn of 1933; at laying-down, plots received lime at 1 ton per acre, superphosphate at 3 cwt., and 30 per cent. potash salts at 2 cwt. per acre. At the end of two years and a half, fertilizer responses on Red Hill sand show an excellent response (Fig. 9) to superphosphate, a slight additional benefit for lime when used with superphosphate and no response for potash.

Experiment 16/1/98 (D) was laid down in July, 1929, and kept under observation until June, 1933. In this experiment basic slag and rock phosphate were used in addition to superphosphate. At

FIG. 7. PASTURE-SWARD COMMONLY SEEN ON PODSOLIZED TE KOPURU SAND.

Stunted paspalum, *Lotus hispidus*, sweet vernal, suckling clover, and catsear. Note sweet vernal in flower. Photo taken 18/10/35.

FIG. 8. TOP-DRESSED ORIGINAL PASTURE ON RED HILL SAND SURFACE-SOWN AFTER BURNING.

Sward improves in colour, suckling clover comes in, and photo shows resultant sward, which consists of ratstail, danthonia, suckling clover, catsear, and sorrel—a very poor low-producing sward.

the end of four years fertilizer response on Te Kopuru sand show an outstanding response for basic slag plus lime, whilst basic slag alone was equal to superphosphate plus lime. Superphosphate alone gave a disappointing response, while no response was given for potash.

Superphosphate on the Red Hill sand and basic slag on the Te Kopuru sand appear to be the best types of phosphate, while a good establishment of white clover is necessary to supply the nitrogen. The experiments show that there is a general lack of response to lime alone, but lime gives an increased response when used in addition to superphosphate and basic slag.

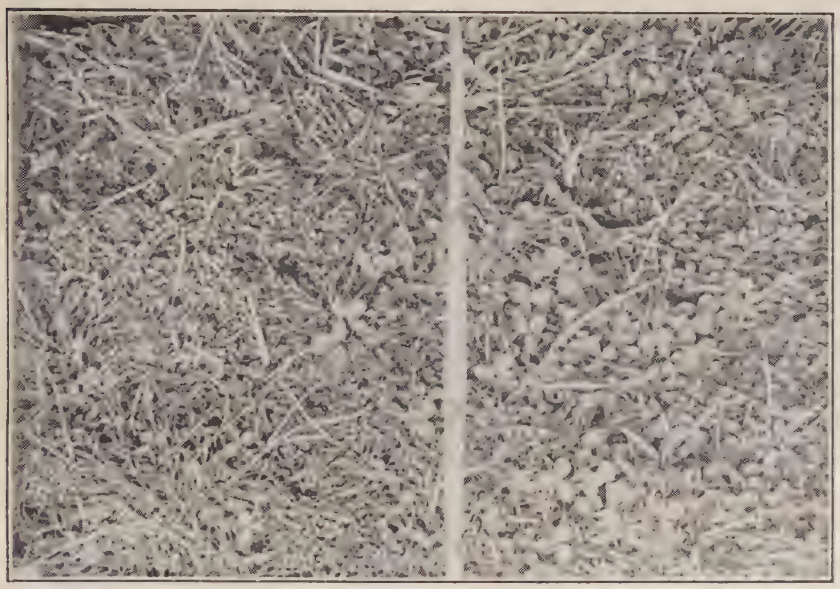

FIG. 9. SUPERPHOSPHATE MAINTAINS AN EXCELLENT PASTURE SWARD ON RED HILL SAND.

Pasture was sown autumn, 1932, both plots received same treatment at laying-down. Right-hand portion of picture has been top-dressed annually with superphosphate at 3 cwt. per acre; left-hand portion shows rapid deterioration taken place after discontinuing annual applications of superphosphate for two years—white clover is being replaced by suckling clover, rye-grass is becoming open and lacking vitality.

Grassing.

The areas of Red Hill sand, being younger, have not been leached to the same extent as the Te Kopuru sand. They make good dairying land and are being fairly rapidly developed for this purpose. The soil is light, not very well supplied with humus, and the development into high-class dairying pastures requires

careful cultivation aiming at a good firm seed-bed, followed by adequate phosphatic manuring. Grassing can be done in three ways :—

(1) After clearing and burning, the land can be lightly surface-cultivated and a cheap temporary pasture-mixture consisting chiefly of *Lotus hispidus* can be sown. This temporary pasture builds up fertility and makes subsequent permanent grassing easier.

FIG. 10. THE SEED-BED MUST BE CONSOLIDATED FOR GOOD WHITE-CLOVER ESTABLISHMENT.

Picture shows establishment of pasture on Red Hill sand six months after sowing. Right-hand portion shows good establishment on a consolidated seed-bed, while poor establishment, especially clover, is seen on the left-hand portion of the picture where consolidation is poor.

(2) After clearing and burning the land can be ploughed, sown in permanent grass, and fertility raised by heavy applications of phosphates. This method is dependent on a good initial strike of white clover—further phosphates encourage the clover and the clover in turn encourages the grass. For this method to succeed it is necessary that the land be ploughed early, cultivated thoroughly throughout the summer months to a firm seed-bed, and the grass and clover sown early in the autumn so that plants become well established before the cold winter westerly winds start to blow.

(3) After clearing and burning, the land can be ploughed during the late autumn or early winter and then sown in root crops, such as soft turnips, for summer feeding. Here, again, it is necessary to raise the fertility for successful permanent pasture establishment by good cultivation and heavy applications of phosphatic fertilizers. This method is perhaps the most economical—the Red

Hill sand grows excellent root crops, and soft turnips are very valuable for feeding to the dairy stock from Christmas on through the summer months, when the pastures generally dry up through the inability of the soil to hold moisture.

Cultivation is important. A good seed-bed for grass is clean, sweet, moist, fine, and firm at the time of sowing. The seed-bed must be consolidated from below up (Fig. 10).

FIG. 11. PASPALUM - SUBTERRANEAN-CLOVER PASTURE WITH A LITTLE RYE-GRASS ON RED HILL SAND.

An excellent association where rye-grass is difficult to establish and maintain.

Experience has shown that the most suitable cultivation for this sandy land preparatory to grass is to plough with a lea mould-board plough, 6 in. deep (the better the ploughing the easier it will be for the subsequent work of seed-bed preparation). The soil should be fallow for at least four or five months to allow of weathering and good aeration, and for the furrow-slices to close together. It is advisable to roll on the furrow with a Cambridge roller, to double disk to a fine seed-bed, followed by the tyne or chain harrows to level the surface. It should be rolled before sowing the seed and fertilizer, and the seed covered with light chain harrows and finally rolled again.

Ploughing with a lea or long mouldboard plough is preferable to doing the work with a plough of the digger mouldboard type, as, with the former, subsequent consolidation is easier. Rolling on the furrow with the Cambridge roller is most important; rolling should be done in the direction of the ploughing, and the heavier

the roller the better. This rolling consolidates the bottom of the seed-bed, and brings the soil moved by the plough in close contact with the unmoved subsoil, making a continuous firm layer of soil through which soil moisture may move from the deeper layers to the surface.

There are two main types of pasture established on the consolidated sand areas, viz. :—

(1) A paspalum - subterranean-clover pasture :
(2) A rye-grass - cocksfoot - paspalum - white-clover pasture.

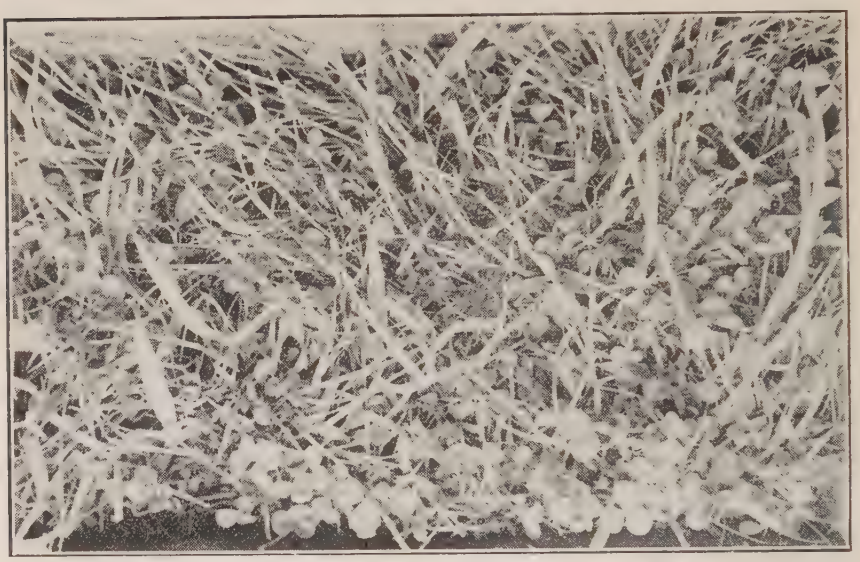

FIG. 12. RYE-GRASS - COCKSFOOT - WHITE-CLOVER - PASPALUM PASTURE.

The ideal type of pasture-sward which is growing vigorously on the Red Hill sand areas. Pasture sown March, 1933, had adequate phosphatic top-dressing during the first year, and has been top-dressed annually with 3 cwt. superphosphate each autumn. Photo taken 16/10/35.

The paspalum - subterranean-clover pasture (Fig. 11) is found where farming is carried out on extensive rather than intensive lines and where only light top-dressing is practised. It is an excellent association where rye-grass is difficult to establish and maintain. Paspalum has good summer growth, whilst subterranean clover is an annual. It buries its own seeds, and the young plants live up to February–March. They grow well in the autumn, winter, and spring, grow vigorously in October, November, and December, and then wither and die. This association appears to be more suited to the Te Kopuru sands ; it is fairly easy to establish, but the growth from subterranean clover is not very great on this poorly drained soil type. White clover is difficult to establish and maintain, and subterranean clover with *Lotus hispidus* and suckling clover forms a good companion for paspalum.

The rye-grass - cocksfoot - white-clover - paspalum pasture (Fig. 12) is found growing vigorously in the Red Hill sand soil type. A

consolidated seed-bed (Fig. 13) with heavy phosphatic top-dressing is necessary to raise the fertility to a level required by rye-grass. The mixture sown to produce the sward illustrated in Fig. 12 consisted of—certified perennial rye-grass, 25 lb.; paspalum, 5 lb.; cocksfoot, 5 lb.; crested dogstail, 3 lb.; red clover, 2 lb.; and certified white clover 2 lb. per acre. The whole success of sowing this mixture depends on using certified perennial rye-grass and certified white-clover seed. Before certified rye-grass and white-clover seed was available it was impossible to establish on these soils a dominant rye-grass pasture, for the short-lived strains of rye-grass "went

FIG. 13. DOMINANT WHITE-CLOVER SWARD.

Sown with same mixture and same time as Fig. 12, but in an unconsolidated seed-bed. White clover failed to strike in loose seed-bed, rye-grass and other species came through, but failed to exist without white clover; during the second year, when natural consolidation took place, white clover came away rapidly, resulting in a mat of dominant white clover.

out" very rapidly. Heavy phosphatic manuring is also required—at least 3 cwt. of superphosphate per acre should be applied with the seed, followed by another dressing of 3 cwt. per acre three or four months later, and thereafter a dressing of superphosphate should be applied each autumn at the rate of at least 3 cwt. per acre. Treated in this way the pastures are capable of a butterfat-production of up to 150 lb. per acre. Early sowing is also most important. This is a rule which can be adhered to for most soil types—do not wait for rain before sowing, this is not necessary if cultivation has been done thoroughly; for good pasture establishment sow while the surface soil is dry, or when a cloud of dust is following the harrows.

Development.

During the summer of 1932 two large blocks of Red Hill sand areas were purchased by the Government and settled with unemployed married men under the Small-farm Scheme. The blocks are shown on the plan (Fig. 1) as Wilson's and Bassett's blocks. Wilson's block consists of twenty-one sections, and is situated on the west coast about nine miles from Dargaville, while Bassett's block, which consists of eleven sections, is situated farther south, about sixteen miles from Dargaville. Each section on both blocks consists of approximately 50 acres. Development work was carried out on these blocks during the autumn of 1933.

FIG. 14. RYE-GRASS - WHITE-CLOVER - COCKSFOOT SWARD.

Another example of a good sward on Red Hill sand. Paspalum is being crowded out by the vigorous growth of other species.

The results have exceeded all expectations, and the areas dealt with are now carrying an excellent sole of grass consisting mainly of rye-grass, cocksfoot, and white clover. The growth of grasses and clover has been so vigorous that paspalum has had little chance to establish (Fig. 14).

The carrying-capacity of these small farms is increasing rapidly, and the sections are now carrying up to thirty milking cows producing up to 7,500 lb. of butterfat on the better sections.

Subsequent management is along similar lines to other grass-land—with heavy stocking and regular manuring, fertility is raised, more stock means more manure, more manure means more grass, and more grass means more live-stock can be carried.

The Red Hill sand can be developed fairly cheaply. The scrub covering is light, and if burnt off two years ahead of

ploughing the cost of clearing is negligible. Cultivation, allowing full costs for labour and feed, costs £2 to £2 10s. per acre, grass-seed £1 10s. to £1 15s. per acre, fertilizer about £1 10s. per acre, fencing for fully developed farms £2 to £3 per acre, water £1 10s. to £2 per acre. This latter cost is most difficult to assess, as the land is naturally watered by creeks or lakes. Water generally has to be pumped to a higher level and then reticulated over the farm by gravitation. On Wilson's and Bassett's blocks a large engine and pump have been installed. The water is pumped into a large reservoir placed on a high hill, from

FIG. 15. PHOSPHATIC TOP-DRESSING IS ESSENTIAL TO MAINTAIN WHITE CLOVER IN THE SWARD.

White clover practically all replaced by suckling clover through lack of phosphatic top-dressing. Sown with the same mixture and at the same time as Fig. 12.

there it runs to each farm—drinking-troughs are placed in the various paddocks, and an ample supply reaches each section by gravitation.

When developed and sown with good types and strains of permanent grasses and clovers the Red Hill sand areas should be useful country for fat-lamb raising and dairying. Recent work has proved that good high-producing pastures can be established now certified grass and clover seeds are available. The country generally consists of easy undulating hills, which can be easily ploughed. Not far removed from the sea-coast, it is situated in an excellent position when the health of sheep and cattle has to be considered. The land is healthy in winter and

summer, gives a good winter growth—although it may become somewhat dry during the summer months—it is well watered with lakes, and is easy to road.

Cultivation is easy and excellent root crops can be grown. Rape can be grown successfully, and a large area of the country gives one the impression that it would be excellent sheep country, especially for fat-lamb raising.

ACKNOWLEDGMENTS.

The writer wishes to thank Dr. H. H. Allan, of the Plant Research Bureau, Palmerston North, for the assistance he gave in identifying the plants found growing on the consolidated sand areas.

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COBALT-FEEDING EXPERIMENT AT AROHENA.

C. S. M. HOPKIRK, Veterinary Laboratory, Department of Agriculture, Wallaceville.

IN the latter part of 1936 an attempt was made to get representative farmers on the different volcanic showers of the centre of the North Island where bush sickness exists to carry out drenching trials with cobalt. This was considered necessary in order to find out whether there was a response to cobalt in the North Island similar to that found by workers of Cawthron Institute in the South Island at Glenhope.

Farmers in all areas where bush sickness was known to exist in cattle or sheep had become accustomed to feeding out limonite-salt licks, and on this account were rather loath to undertake the additional work which a drenching experiment would entail. An experiment became possible in two areas, however, the one the Government farm at Mamaku and the other the property owned by Mr. A. R. Weal, Arohena. Mamaku experiments are not yet sufficiently advanced to report. These two farms represented two different volcanic showers, that at Arohena being on the large Taupo shower. Mr. Weal, who had had considerable trouble with bush sickness in his sheep in the past, very kindly offered to place ewes with lambs at the disposal of the Department of Agriculture and to carry out the necessary drenching of the sheep and lambs.

Four groups were decided upon :—

(1) Four ewes to be dosed twice weekly with 3·5 c.c. of a solution of cobalt sulphate at the rate of 1 mg. of the cobalt salt per day ; four lambs to receive 3·5 c.c. of the same solution once a week.
(2) Four ewes to be drenched with a solution of similar strength weekly, in doses of 7 c.c. ; four lambs to receive 3·5 c.c. once weekly.
(3) Four ewes to be dosed once a month with 30 c.c. of the stock solution, while four lambs received 15 c.c. once a month.
(4) Nine ewes and nine lambs to be left as controls.

All sheep were to be weighed once a month, and the state of health noted. Examination of blood-samples was, unfortunately, not possible, because of the difficulty of obtaining samples and getting them to a laboratory.

Weights in pounds were obtained as follows:—

— —	13/11/36.	15/12/36.	15/1/37.	16/2/37.	17/3/37.	16/4/37.
Lot No. 1: 4 Ewes, 4 Lambs.						
Ewe—						
No. 604	129	135	131	137	143	126
No. 606	139	145	140	142	151	159
No. 608	119	126	122	132	138	138
No. 610	154	140	126	131	139	142
Average weight ..	135·25	136·5	129·75	135·5	142·75	141·25
Lamb—						
No. 605	36	51	61	72	80	88
No. 607	35	47	66	81	88	84
No. 609	16	21	34	43	49	53
No. 611	29	42	55	58	73	81
Average weight ..	29	40·25	54	63·5	72·5	76·5
Lot No. 2: 4 Ewes, 4 Lambs.						
Ewe—						
No. 612	114	124	118	148	134	144
No. 614	115	123	98	110	122	128
No. 616	128	142	121	130	141	141
No. 618	136	131	136	135	142	146
Average weight ..	123·25	130	118·25	130·75	134·75	139·75
Lamb—						
No. 613	31	40	58	70	74	81
No. 615	25	39	55	65	70	77
No. 617	28	43	61	78	82	87
No. 619	19	Dead	..	..	..	..
Average weight ..	25·75	40·7	58	71	75·3	81·7
Lot No. 3: 4 Ewes, 4 Lambs.						
Ewe—						
No. 620	121	128	113	118	122	130
No. 622	113	125	109	111	117	120
No. 624	118	118	105	102	103	100
No. 628	123	126	107	81	Dead	..
Average weight ..	118·75	124·25	108·5	103	114	116·7
Lamb—						
No. 621	38	59	76	80	79	80
No. 623	39	53	59	65	60	63
No. 627	22	28	35	34	35	40
No. 629	27	44	57	60	54	53
Average weight ..	31·5	46	56·25	59·75	57	59

	13/11/36.	15/12/36.	15/1/37.	16/2/37.	17/3/37.	16/4/37.
Lot 4: 9 Ewes, 9 Lambs.						
Ewe—						
No. 630	150	142	121	125	117	108
No. 632	138	144	121	121	131	125
*No. 634	118	106	90	88	85	88
No. 636	138	152	133	130	139	128
*No. 638	128	111	92	93	93	99
No. 640	118	104	Missing	..	..	..
*No. 642	93	87	76	88	92	93
No. 644	86	79	86	Missing	..	..
*No. 646	89	83	68	69	80	81
Average weight ..	117·5	112	98·4	102	105·3	103·1
Lamb—						
No. 631	15	21	Dead	..	..	..
No. 633	37	52	66	63	60	60
†No. 635	24	29	20	Dead	..	..
No. 637	35	53	62	71	73	70
†No. 639	19	21	25	27	30	31
†No. 641	25	32	37	43	42	47
†No. 643	31	33	32	28	Dead	..
No. 645	17	Dead	..	..	..	..
No. 647	22	29	28	31	32	35
Average weight ..	25	33·7	38·6	43·8	47·4	48·6

* Dosed on 15/1/37, 16/2/37, 17/3/37, and 16/4/37 with 30 c.c. cobalt owing to their showing signs of weakening.

† Dosed on 15/1/37, 16/2/37, 17/3/37, and 16/4/37 with 15 c.c. cobalt owing to their showing signs of weakening.

Discussion.

The first two groups of ewes did well, and were at the last weighing in splendid condition. Their lambs also put on weight, and, except for the unaccountable death of lamb 619 after the first weighing, are in good order.

The third group, where monthly dosing was carried out, did not do nearly so well. One ewe died, but not from bush sickness, while the lambs put on weight slowly. This group is intermediate in appearance between the first two and the last.

The fourth group did badly, two ewes and four lambs dying. Others, which were getting extremely weak, were dosed with cobalt to save their lives. These are marked in the table. In appearance the group is very poor, and if cobalt had not been given the majority would have died.

The experiment has shown that cobalt is efficacious in preventing bush sickness in the Arohena district if given at regular intervals of once or twice a week. From previous work on elimination of the metal carried out by Askew and Josland, the optimum period for drenching has been shown to be twice a week, but with the amount given in this trial dosing once a week was quite sufficient. Dosing once a month was tried out because of the fact that some farmers have been giving large doses of 500 mg. and more at long intervals. Group three shows that the practice of dosing at intervals of a month is not sufficient to keep lambs growing at an optimum, although they remain healthy.

FIG. 1. LOT 1: DOSED WITH 5 C.C. OF COBALT SOLUTION TWICE WEEKLY.

FIG. 2. LOT 2: DOSED WITH 7 C.C. OF COBALT SOLUTION TWICE WEEKLY.
One lamb in centre of this lot belongs to Lot 1.

FIG. 3. LOT 3: DOSED WITH 30 C.C. OF COBALT SOLUTION TWICE WEEKLY.

FIG. 4. CONTROL LOT.

It should be pointed out that, although drenching with cobalt has been tried experimentally, it is not a practical method of control of bush sickness, as the labour involved is irksome and impossible when numbers of sheep have to be kept in health. The training of sheep and cattle to take limonite licks of high cobalt content is, as yet, the only practical means of controlling the mortality.

The thanks of the author are due to Mr. A. R. Weal, who made the experiment possible, and to Mr. G. Melrose, Inspector of Stock, Te Awamutu, who weighed the sheep and supervised the experiment carefully and who supplied the photographs.

BIENNIAL CROPPING OF APPLES.

R. G. HAMILTON, Orchard Instructor, Hamilton.

IN the fruit industry to-day it is widely recognized that a high level in production is desirable. Furthermore, it is also realized that fluctuations in crop totals from year to year have a decided detrimental effect upon the stability of markets, and finally upon the grower's net return. In consequence it is the endeavour of most orchardists to secure consistent rather than spasmodic crops.

Biennial cropping, by which is meant the tendency of a fruit-tree to bear a heavy crop every alternate year and light crops in the intervening years, is probably the greatest factor against securing consistent crops.

Many varieties of apples, principally those which are spur bearers, are affected by biennial cropping. This habit may first be brought about by any factor, natural or otherwise, which causes an exceptionally heavy crop in any year. Once the natural balance has become upset the cycle of biennial cropping quickly becomes established, and careful treatment is required to correct the trouble and again bring about average annual crops.

To understand corrective treatment better a grasp of the causes underlying the cycle of biennial crops is desirable.

When the tree carries an exceptionally heavy crop, one which is beyond its normal capacity, the phenomenal demand made by the growing fruit seriously depletes the elaborated sap-supply, and results in the semi-starvation of the developing fruit-buds. Consequent upon this semi-starvation, the majority of the fruit-buds remain undeveloped and fail to produce fruit the following season.

During the season of the light crop the surplus of elaborated sap produces excessive bud-development, with a consequent heavy crop the following season, and so the cycle continues.

The apparent limiting factor is that of elaborated sap. This may be caused by a lack of an adequate and available food-supply to the roots, or by insufficient leafage to elaborate the available sap, or by both of these. The spur-bearing varieties, apparently because of their sparse leafage, are more prone to be thrown out of balance by a heavy crop.

In a previous article on this subject entitled "Biennial Bearing in Apple-trees" (this *Journal*, Vol. 44, No. 17, pp. 38–41), the writer discussed methods of overcoming the biennial-cropping habit, and the following

observational experiment which was carried out amply supports the contention that this unfavourable aspect of fruitgrowing may be overcome. The observation was made possible by the ready co-operation of Mr. W. J. McMiken, of Hamilton, who carried out the suggested treatment in his orchard, and later adopted the practice generally on apple-trees in his orchard.

The variety, Dunn's Favourite, was selected for the purposes of the observational test, because it is considered to be one of the varieties most prone to be thrown out of consistent cropping.

The particular trees were planted in 1914, and were well grown, being approximately 12 ft. to 14 ft. high and having a 14 ft. spread. The average number of leaders on a tree was in the vicinity of twenty-four. At the commencement of the observations the trees were heavily laden with short fruit-spurs, while practically no lateral growth was to be found. The trees had a rather exhausted and stagnant appearance.

Over the previous few years the crops were estimated by Mr. McMiken as being from 3 to 5 bushels in the "light" years and from 14 to 16 bushels in the "heavy" years.

Annual manuring had been carried out, the trees receiving approximately 3 lb. of superphosphate and 2 lb. of bonedust each. Green manuring with blue lupins had also been commenced in 1928.

The method of improvement was by (1) increased manuring, continued growing and ploughing under of green crops, and by (2) an improved system of pruning.

In the winter of 1930 a heavy reduction was made in the number of spurs carried by the trees, approximately 50 per cent. being cut away, and a commencement made in the reduction of the number of leaders by thinning out from three to four in each tree. The manuring was increased by 1 lb. of superphosphate per tree.

The following season was the "light" year, and a large amount of new lateral growth was produced. In the winter this new growth was left uncut, while a further inroad was made into the remaining old spurs, and approximately 20 per cent were removed. The leaders were reduced in most of the trees by a further two. The manuring was increased to 8 lb. per tree, comprising 6 lb. of superphosphate and 2 lb. of bonedust.

The second season was due in the cycle as a "heavy" year. With the heavy thinning of the fruit-spurs, followed by a heavy thinning of the fruit, the crop was reduced and approximately only 10 bushels per tree were carried. Extensive new lateral growth was made, while a heavy development of fruit-buds took place on the previous year's uncut laterals. At the winter pruning approximately 30 per cent. of the remaining old spurs were cut away, and all new growth, except where crowding, was left intact. The leaders were again slightly reduced in numbers.

In the summer of 1933 the trees now presented quite a different appearance, being liberally furnished with new lateral growth. The development of healthy buds had been extensive, and the promise was for a heavy crop in what would, in the old cycle, have been a "light" year. In the manurial programme an increase to 10 lb. per tree was made, which consisted of sulphate of ammonia 1½ lb., superphosphate 6 lb., and bonedust 2½ lb.

The following season turned out to be one of heavy crop, close on 20 bushels per tree being produced. The majority of the fruit was now being carried on the lateral wood. Despite the heavy crop new lateral growth was satisfactory.

Since then, with the exception of one year when a late frost lowered the crop, cropping has been consistent, and this season sees the fourth consistent crop of over 20 bushels per tree.

Each winter the pruning has been on the same basis, that of cutting away the old and exhausted wood, and leaving the new lateral growth to take its place in the sequence of fruiting. The provision of lateral growth has provided the tree with increased leafage, and the benefit is to be seen in the healthy rejuvenated appearance of the trees.

The manuring has been gradually increased, sulphate of potash being added in 1934 and since. Carbonate of lime, 12 cwt. to the acre, was applied in June, 1935. Last year's manuring consisted of 15 lb. per tree applied in August of a mixture containing fish manure, bonedust, and sulphate of potash at a ratio of 2–10–3, and in October with 4 lb. per tree of meat-meal.

As a result of this season's satisfactory crop, together with further satisfactory new lateral growth and good fruit-bud development, it is considered that these trees have now been established in consistent cropping.

Other biennial cropping varieties in the same orchard appear to have responded in a like manner, and have reverted to annual average cropping.

In orchard practice it must be recognized that increased quantities of manure at times must be applied if heavy crops, together with sufficient new growth, are to be maintained. Increased manuring, however, will not correct biennial cropping or maintain consistent crops unless it is associated with the correct pruning practice. Briefly put, this consists, in the case of all apple-trees, of the removal each winter of the older and more exhausted fruiting-wood, and the spacing and leaving unshortened of all one-year-old lateral growth.

At a large meeting of farmers at Rakaia in May a discussion took place regarding the growing of blue lupins for sheep-feed. There was great diversity of opinion, but the majority state that lupins were not good sheep-feed and that stock had to be starved before they would eat the lupins. —*Fields Superintendent, Christchurch.*

Certified White Clover in Canterbury.—In the Rangiora district the common method of establishing mother-seed white-clover areas is to broadcast 3 lb. to 4 lb. of seed on an autumn-sown wheat crop. The white clover is sown in the spring after the wheat has been rolled, and light harrows are used to cover the seed. Although this is natural white-clover country, some of the stands have been almost complete failures this year. Heavy wheat crops have sometimes resulted in poor clover establishment. Rather than incur the expenses of preparing the land for spring sowing along with rye-grass, most farmers prefer to risk sowing the high-priced clover-seed with wheat. In one or two cases certified Hawke's Bay rye-grass has been sown with the clover and certified seed of both plants harvested off the same area. Probably the reason for the popularity of sowing with wheat is the excellent manner in which red clover has at times been established. Red clover, however, is more suitable for this practice than white clover, as its upright habit enables it to withstand the shading better, and the deeper rooting-system of red clover enables it to withstand better a dry period, after the wheat has been removed and has left the land depleted of moisture.—*Instructor in Agriculture, Christchurch.*

CERTIFICATION OF SEED POTATOES.

PROVISIONAL CERTIFICATES ISSUED FOR SEASON 1936–37.

PROVISIONAL certificates are issued with the object of affording growers some indication of the general standard of their crops and assisting them in the disposal of their seed. Certification tags to be attached to the sacks are issued later, provided that an officer of the Department of Agriculture inspects the graded seed potatoes and is satisfied that they are still of the same standard of purity and freedom from disease as was indicated by the field inspection.

Each crop has received a group-number, which indicates as accurately as possible the merits of its produce for seed purposes in relation to the merits of the produce of the other provisionally certified crops of the same variety. Group 1 is the highest and Group 9 the lowest. The difference between any two consecutive groups is small, and in making comparisons the cost of seed and transport should receive consideration.

Crops are also divided into two classes—namely, (1) certified "mother" seed; (2) certified "commercial" seed. Areas sown with certified mother seed are eligible for entry into certification. Areas sown with certified commercial seed are not eligible for entry into certification, except in the case where the seed planted has been raised by the entrant (grower) himself. Growers who intend to purchase seed with the object of entering certification must therefore purchase certified mother seed.

LIST OF GROWERS.

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
AUCKLANDER SHORT TOP.			
Mother Seed (Canterbury and Marlborough)—			
Acland, L. G. D., Hororata	3	..	1
Adams Bros., Sheffield (Line A)	3	..	9
Aker, H. W., Hawthornden Road, Upper Riccarton	3	0·2	3
Aymes, H. C., "Riversleigh," Annat	3	..	3
Anderson, A., "Crofthead," Southbridge	3	0·2	9
Annett, C., St. Andrews	2	..	1½
Baker, S., R.M.D., Tycho	3	..	1
Barclay, G. M. M., Riverlands, Waimate (Line B)	3	..	1
Barnes, R., John's Road, Belfast	3	0·5	1
Barnett, R., Dunsandel	3	..	4
Barr, H. C., Springston, R.D.	3	0·3	3
Bennett, R. R., Eyreton, Kaiapoi, R.D. (Line A)	3	..	2
Biggs Bros., Tycho, Timaru	3	..	1½
Black, D. C., Gleniti, Timaru	2	0·2	1
Botting, A. R., Factory Road, Temuka	3	..	1
Boyce, W. J., Waituna, Waimate	2	..	1
Boyle, A. D., Orari (Line B)	3	..	1
Breakwell, A. J., Tinwald (Line C)	2	..	4
Brodie, R., Rangitata Island (Line A)	3	..	1½
Brodie, R., Rangitata Island (Line B)	3	..	1½
Brown, G. E., Kaiapoi, R.M.D. (Line A)	2	..	2
Burnett, W. J., Mina, North Canterbury	2	..	1
Caldwell, G. D., 145 Russley Road, Christchurch (Line A)	3	..	1
Caldwell, G. D., 145 Russley Road, Christchurch (Line B)	3	..	1
Caldwell, G. D., 145 Russley Road, Christchurch (Line C)	3	..	3
Campion, C. A., Mount Hutt, R.D., Rakaia	3	..	3
Carr, J., Mount Hutt, R.M.D., Rakaia	3	..	1½
Carroll, J., Southbridge	2	..	4
Carroll, T. F., Southbridge	3	..	7

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
AUCKLANDER SHORT TOP—*continued.*			
Mother Seed (Canterbury and Marlborough)—continued.			
Cashion, J. J., 168 Yaldhurst Road, Riccarton ..	3	..	1
Chappell, L. J., Killinchy, Leeston, R.M.D. ..	3	..	1
Chappell, T., West Coast Road, Yaldhurst, (Line A)	3	0·2	2
Chatterton, C. S., Dunsandel	3	..	2
Chatterton, W. V., Dunsandel	2	..	2
Cherry Bros., Eyreton, Kaiapoi, R.M.D. (Line A)	3	..	3
Cook, P. D., Albury (Line A)	3	..	2
Cook, P. D., Albury (Line B)	2	..	2
Couper, R. P., Washdyke (Line A)	3	..	2
Crawford, J. A., Yaldhurst	2	..	4
Crawford, R. T., Yaldhurst (Line A)	3	0·5	3
Croft, R., " Glenlea," Amberley	2	..	1½
Cross, A. E., Bennetts, via Rangiora (Line A) ..	3	..	1
Cross, A. E., Bennetts, via Rangiora (Line B) ..	3	..	1½
Cross, H. E., Sandy Knolls	3	..	1
Crowe, D. and J., Waimate	3	0·4	1
Crozier, W. J., Mount Hutt, R.M.D., Rakaia (Line A)	2	..	5
Crozier, W. J., Mount Hutt, R.M.D., Rakaia (Line B)	2	..	10
Crump, F., Springston, R.M.D.	3	..	2
Currie, W., Winchester	3	..	1½
Curtis, J. J., Yaldhurst	3	..	1
Dale Bros., Maungati	3	..	2
Daniel, E., Kingsdown, Timaru	3	..	1
Davidson, J., Oxford Road, Rangiora ..	1	..	1
Dillon, J. G., Courtenay, R.M.D.	2	..	18
Doyle, P. J., Gleniti, Timaru	3	..	1½
Elliott, D., Albury	2	..	1
Everest, care of J. Crozier, Crozier's Road, Christchurch (Line A)	3	0·1	1½
Everest, care of J. Crozier, Crozier's Road, Christchurch (Line B)	3	0·3	4
Ford, B. A. C., Greendale, R.M.D. (Line A) ..	2	..	3
Ford, B. A. C., Greendale, R.M.D. (Line B) ..	3	0·2	3
Ford, L., Salisbury	3	..	1
Fowler, G. H., Halkett	2	0·8	1
France, D., Levels	2	..	1
Franks, L. J., 88 Russley Road, Christchurch, N.W. 3 (Line A)	2	..	2
Franks, L. J., 88 Russley Road, Christchurch, N.W. 3 (Line B)	2	..	1
Franks, L. J., 88 Russley Road, Christchurch, N.W. 3 (Line C)	3	..	2
Frost, C. H., Balcairn P.O. (Line A)	2	..	1
Frost, C. H., Balcairn P.O. (Line B)	3	..	1
Gardiner, O. J., Dunsandel, R.M.D.	2	0·3	2
Gardiner Bros., Upper Waitohi	2	..	1
Gaskell, L., 112 Russley Road, Upper Riccarton	2	0·2	5
Gilbert, D. R., East Oxford	3	0·5	1
Giles, L. W. E., Kaiapoi, R.M.D.	2	..	4
Giles, V. R., Kaiapoi, R.M.D.	3	..	3
Gillett, G. N. H., Koromiko, Marlborough ..	3	..	1½
Gray, J. L., St. Andrews (Line C)	2	..	3
Gray, P. B., Hadlow, Tycho, R.M.D. (Line A) ..	2	..	1
Gray, P. B., Hadlow, Tycho, R.M.D. (Line B) ..	3	..	3

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
AUCKLANDER SHORT TOP—*continued.*			
Mother Seed (Canterbury and Marlborough)—continued.			
Gray, R., St. Andrews (Line A)	3	..	7
Gray, R., St. Andrews (Line C)	2	..	3
Green, J., Gleniti, Timaru	2	..	2
Guy, T. A., and E. B., Courtenay, R.M.D.	2	..	6
Hansen, P., Washdyke	3	..	1
Harrison-Wilke, E. L., Courtenay, R.M.D.	2	..	1½
Harvey, W., Willowby, Ashburton (Line A)	2	..	2
Hawkins, A. T., Sheffield, R.M.D.	2	..	1½
Hayes, G. B., Halkett, R.M.D.	2	..	1½
Henderson, G. H., Courtenay, R.M.D.	3	0·3	2
Henderson, J. L., Pleasant Point	2	..	1
Inch, H. V., 104 Ryan's Road, Fendalton, N.W. 3	3	..	10
Johnston, R. H., Dunsandel	3	..	2
Jowers, G. C., Darfield, R.M.D. (Line A)	3	..	1
Judson, C. J., High Street, Rangiora (Line A)	3	..	4
Judson, C. J., High Street, Rangiora (Line B)	3	..	5
Kavanagh, Mrs. M., 50 Ryan's Road, Upper Riccarton	3	0·5	20
Kelleher, T., Pleasant Point (Line A)	3	..	4
Kelleher, T., Pleasant Point (Line B)	3	..	4
Kelleher, T., Pleasant Point (Line C)	3	..	2
Kennedy, L. J., Postman's Road, Kaikoura (Line B)	3	..	1
Kenyon, F., Oxford Road, Rangiora	3	..	3
King, G. H., West Belt, Rangiora (Line A)	3	..	4
King, G. H., West Belt, Rangiora (Line D)	3	..	1
King, J. C., Box 82, Timaru (Line A)	2	..	1
King, W. H., Rosewill, Timaru (Line A)	2	..	1
King, W. H., Rosewill, Timaru (Line B)	3	..	3
Lewis, T. G., Geraldine	3	..	2
Longman, Mrs. M., Pareora	2	..	1
Macdonald, A., Buchanan's Road, Sockburn	3	..	1
McLeod, J. A., Tycho	3	..	1
McPhail, W. A., Mitcham, via Rakaia (Line A)	2	..	1
McPhail, W. A., Mitcham, via Rakaia (Line B)	2	..	2
McRobb, A., Mount Hutt, R.M.D., Rakaia	2	..	1
Mackle Bros., Kaikoura Suburban	3	..	1
Markham, C. W., Fairview Road, Timaru	3	..	1
Marshall, D., Killinchy, Leeston, R.M.D.	2	..	14
Marshall, S. A., Tycho, R.M.D. (Line B)	2	..	1
Marshall, W. H., Prebbleton	3	..	5
Meyer Bros., Waimate	2	..	1
Morgan, D., Cheviot, R.M.D.	1	..	15
Moriarty, L., Southbridge	3	..	1
Morrison, T. F., Levels Valley	2	..	1
Mortland, Mrs. S., Templeton (Line A)	3	..	6
Muff Bros., Orari	2	..	1
N.Z. Loan and Mercantile Agency, Christchurch (Line C)	3	0·3	4
N.Z. Loan and Mercantile Agency, Christchurch (Line D)	2	..	5
Oakley, H. R., Eiffelton	3	..	4
Oakley, W., Hororata (Line A)	2	..	6
Oakley, W., Hororata (Line B)	3	..	7
Oakley, W., Hororata (Line C)	3	..	13
Oliver, J. O. J., Factory Road, Temuka	3	..	3
Oliver, W. R., Hororata	3	..	2

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
AUCKLANDER SHORT TOP—*continued.*			
Mother Seed (Canterbury and Marlborough)—continued.			
Oliver, Mrs. Z. M., Factory Road, Temuka ..	3	..	1½
Orbell, W. H., Levels	3	..	1
Pascoe, S., Halkett	3	..	20
Patterson, A., East Eyreton, Kaiapoi, R.M.D. (Line A)	2	..	1
Patterson, A., East Eyreton, Kaiapoi, R.M.D. (Line B)	3	..	4
Payne, J., sen., Springston, R.M.D.	2	..	2
Pearcy, R. P. B., Grove, Marlborough	3	..	2
Petrie, H. H., Swannanoa, R.M.D., Rangiora ..	3	..	1
Petrie, J., jun., Swannanoa, R.M.D.	3	..	2
Petrie, J., sen., Swannanoa, R.M.D.	3	..	6
Phillips, A., Weedons-Springston, R.M.D.	2	..	2
Phillips, W., Springston, R.M.D.	1	..	2
Porter, E., St. Andrews (Line A)	3	..	2
Proudlock, A., East Eyreton, Kaiapoi, R.M.D. (Line A)	2	..	1
Proudlock, A., East Eyreton, Kaiapoi, R.M.D. (Line B)	3	..	4
Purvis, G., Oxford Road, Rangiora (Line B) ..	3	..	2
Quinn, M. J., Arowhenua, Temuka	3	..	2
Randall, J., Koromiko, Marlborough (Line A) ..	3	..	1
Randall, J., Koromiko, Marlborough (Line B) ..	3	..	1
Rapley, G. L., Southbridge	3	..	4
Rathgen, Mrs. I., Killinchy, Leeston, R.M.D. ..	1	..	5
Redmond, C., Kimberley, R.M.D.	2	..	10
Redmond, W. G., Courtenay, R.M.D. (Line A)	3	..	8
Redmond, W. G., Courtenay, R.M.D. (Line B) ..	2	..	2
Reid, L., 230 Withells Road, Riccarton ..	3	..	2
Rice, H., Kaiapoi	3	..	5
Rich, A. J., Kaiapoi, R.M.D. (Line A) ..	3	0·2	10
Rich, A. J., Kaiapoi, R.M.D. (Line B) ..	3	..	5
Richmond, W. T., Willowbridge (Line A) ..	3	..	2
Richmond, W. T., Willowbridge (Line B) ..	3	..	2
Robinson, L. C., Levels	3	..	1½
Roper, R. S., Halkett	3	0·5	2
Rose, C. F., Hook, R.M.D., Timaru (Line A) ..	2	..	4
Rose, C. F., Hook, R.M.D., Timaru (Line B) ..	3	..	2
Rouse, J. F., St. Andrews (Line A)	3	..	2
Rouse, W., St. Andrews	3	..	1
Royds, R. S., 412 Burnside Road, Fendalton, N.W. 1	3	..	13
Ruston, W. J., jun., Gleniti, Timaru	3	..	1½
Sadler, T., Courtenay, R.M.D.	2	..	10
Sauer, J., St. Andrews	3	..	1
Saunders, A. C., 110 Withell's Road, Yaldhurst	3	..	3
Saunders, E. E., Studholme Junction	3	..	2
Schluter Bros., Rangiora (Line A)	3	..	3
Scott, A., Kerrytown (Line B)	3	..	3
Seaton Bros., Courtenay, R.M.D.	2	0·5	3
Shirlow, E., Kaiapoi, R.M.D.	3	0·3	2
Sievwright, R. M., Washdyke (Line B) ..	3	..	3
Simpson, F. F., Morven (Line A)	3	..	6
Somerville, H. J. R., Box 44, Timaru (Line A) ..	2	..	3
Somerville, H. J. R., Box 44, Timaru (Line B) ..	3	0·2	17
Steele and Dawson, care of F. Steele, Fernside ..	3	..	3
Steele, J., Kimberley	2	0·3	3

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
AUCKLANDER SHORT TOP—*continued.*			
Mother Seed (Canterbury and Marlborough)—continued.			
Steven, G. H., Rosewill, Timaru (Line A) ..	3	..	2
Steven, G. H., Rosewill, Timaru (Line B) ..	3	..	5
Steven, G. H., Rosewill, Timaru (Line C) ..	3	..	4
Stewart, A., Marsh's Road, Templeton (Line A)	3	..	5
Stewart, A., Marsh's Road, Templeton (Line B)	1	..	5
Storer, G., Halswell	3	0·2	5
Swanson, W., Selwyn	2	..	1½
Taggart, R., Ltd., 79 Middlepark Road, Riccarton	3	0·2	1
Thomas, J. W., Gray's Road, Christchurch, N.W. 3	2	0·2	4
Turner, C. W., Courtenay, R.M.D.	2	0·2	2
Turner, G. A., Courtenay, R.M.D.	3	..	2
Tweedy, S., Dunsandel, R.M.D.	2	..	6
Walker, C. E. (Estate), Christchurch, Greendale, R.M.D.	2	..	4
Walker, W. H., jun., Halkett, R.M.D. (Line A)	3	0·3	2
Walker, W. H., jun., Halkett, R.M.D. (Line B)	3	..	2
Walker, W. H., jun., Halkett, R.M.D. (Line C)	3	..	2
Wallace, D. W., Main South Road, Timaru ..	3	..	1
Watson, M. E. M., Dunsandel	3	..	2
Watson, R. G., Cust	3	0·8	4
Westaway, R. J., Christchurch, Greendale, R.M.D.	2	..	18
Whearty Bros., Wheatstone, Ashburton ..	2	..	1
Wilson Bros., Halkett, R.M.D. (Line A) ..	2	0·5	1½
Wilson Bros., Halkett, R.M.D. (Line B) ..	1	..	1½
Wilson Bros., Halkett, R.M.D. (Line C) ..	3	..	10
Wilson Bros., Halkett, R.M.D. (Line D) ..	3	0·5	2
Wilson Bros., Halkett, R.M.D. (Line E) ..	3	..	3
Wilson, C. T., Halkett, R.M.D.	2	..	2
Wilson, M., Halkett, R.M.D. (Line A) ..	2	..	2
Wilson, M., Halkett, R.M.D. (Line B) ..	3	..	2
Wilson, M. G., Springston, R.M.D. (Line B) ..	3	0·3	2
Wilson, R. R., Halkett	3	..	3
Wilson, S. M., Sefton, R.M.D.	3	..	6
Wilson, W. A., Halkett, R.M.D. (Line A) ..	3	..	4
Wright, L. T., Annat	2	0·2	8
Wright, Q. A., Annat (Line A)	2	..	1
Wright, Q. A., Annat (Line B)	1	..	6
Wright, Q. A., Annat (Line C)	3	0·2	8
Mother Seed (Otago and Southland)—			
Miles, A. C., and E., Portbello, Otago ..	3	..	1½
Scandrett, C., 62 Bowmont Street, Invercargill	2	..	1
Commercial Seed (North Island).—			
Deadman, G. T., Ohakune	5	..	2
Drayton, P., Rangataua	5	..	2
Faull and May, Raetihi	4	..	2
Fetzer, E. L., Ohakune	6	..	3
Foster, E. H., Ohakune	4	..	2
Hing, Jimmie, Ohakune	5	..	1
Hing, Yoi, Ohakune	4	..	6
Holman, A. E., Ohakune	5	..	3
Marshall, F. C., Ohakune	4	..	2
Toland, W. H., Ohakune	4	..	2
Whale, S. D., Ohakune	4	..	1
Commercial Seed (Canterbury and Marlborough)—			
Adams Bros., Sheffield (Line B)	4	0·2	4
Adams, K. and R., Sheffield	4	0·7	7
Alexandre, H., Belfast	4	1·4	10

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
AUCKLANDER SHORT TOP—*continued.*			
Commercial Seed (Canterbury and Marlborough)—continued.			
Amor, A. W., Woodend (Line A)	5	1·0	2
Amor, A. W., Woodend (Line B)	5	1·2	1
Arthur, H., Maungati	4	..	1
Banks, H. B., Banks Avenue, Shirley, Christchurch	4	0·2	1
Barclay, G. M. M., Riverlands, Waimate (Line A)	4	0·4	3
Barnes, W., and Sons, 199 Highsted Road, Styx (Line B)	4	1·1	1
Bennett, R. R., Eyreton, Kaiapoi, R.M.D. (Line B)	5	..	1
Berry and Halliburton,, 28 Dundas Street, Christchurch	5	1·0	4
Bockaert, Mrs. J., St. Andrews (Line A)	4	..	1½
Bockaert, Mrs. J., St. Andrews (Line B)	6	..	1½
Bonnett, N. M., Rangiora	5	..	4
Boyle, A. D., Orari (Line A)	4	..	2
Breakwell, A. J., Tinwald (Line A)	5	0·5	3
Breakwell, A. J., Tinwald (Line B)	4	..	7
Brophy, K., Pleasant Point	6	..	1
Brosnahan, Mrs. H. (Estate of), Seadown, Timaru	5	0·8	14
Brown, G. E., Kaiapoi, R.M.D. (Line B)	4	..	12
Brown, J. L., Washdyke	5	..	1½
Burrell, T. F., Levels	4	0·2	2
Busby, C. V., Kaiapoi (Line A)	6	0·3	1
Busby, C. V., Kaiapoi (Line B)	6	0·5	1
Cague, W., St. Andrews	4	..	1½
Caird, I., Southburn, Timaru (Line A)	5	..	1½
Caird, I., Southburn, Timaru (Line B)	6	..	1
Carroll, F. A., Southbridge	4	..	4
Chambers, A. J., Oxford Road, Rangiora	4	..	3
Chappell, T., West Coast Road, Yaldhurst (Line B)	4	0·3	2
Cherry Bros., Eyreton, Kaiapoi, R.M.D. (Line B)	4	..	5
Chetnole Ltd., Glenavy	6	0·2	40
Clarke, V. G., Fairview, Timaru (Line A)	4	..	10
Clarke, V. G., Fairview, Timaru (Line B)	4	..	6
Cooper, C., Arowhenua, Temuka	4	..	1
Cox, N., 238 Wairarapa Road, Christchurch	4	..	2
Crawford, R. T., Yaldhurst (Line B)	4	..	3
Dale, P., Temuka	4	..	1½
Dellow, G., St. Andrews	5	0·2	1
Dunlop, W. N. G., Courtenay, Greendale, R.M.D.	4	1·7	2
Elder, R. P., 109 John's Road, Belfast	4	..	1
Ellis, M. G., Kingsdown, Timaru	5	..	1½
Elworthy, P. A., Gordon's Valley, South Canterbury	4	0·4	3
Evans, C., Southburn, Timaru	4	..	1
Everest, W., care of J. Crozier, Crozier's Road, Christchurch (Line D)	4	0·3	1½
Foster, J. A., Springston, R.M.D. (Line A)	4	..	15
Foster, J. A., Springston, R.M.D. (Line B)	5	..	8
Gardiner, C., care of O. J. Gardiner, Dunsandel, R.M.D.	4	0·7	1
Gillies, O. N., Seadown	5	..	1
Gray, J. L., St. Andrews (Line A)	4	..	8
Gray, J. L., St. Andrews (Line B)	5	..	30
Gray, R., St. Andrews (Line B)	5	..	5
Haines, C., 108 Waimak Road, Harewood	4	0·3	2
Ham, A., Grovetown, Blenheim	4	..	4

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
AUCKLANDER SHORT TOP—*continued.*			
Commercial Seed (Canterbury and Marlborough)—continued.			
Hampton, G., Kingsdown, Timaru	4	1·0	6
Hampton, G. H., Otipua Road, Timaru ..	5	..	2
Hardy, A., jun., Winchmore, R.M.D.	4	0·6	1
Harvey, W., Willowby, Ashburton (Line B) ..	4	..	1
Hartnett, D., St. Andrews	4	..	1
Hartnett, T., Temuka	4	..	3
Hastie, A. W., Pareora, Timaru	4	0·2	2
Hegan, J., and Son, Southbrook	5	0·3	6
Heinisch, A., Springston, R.M.D.	4	0·7	2
Hewson, Mrs. M. S., Orari	5	..	2
Hill, J., Pareora West	5	..	3
Innes, T. S., Sheffield	4	..	2
James, H. W., 137 Fitzgerald Street, St. Albans, Christchurch	4	1·0	2
Jellie, J., Russley Road, Christchurch ..	4	..	6
Jordan, C. H., Kaiapoi, R.M.D. (Line A) ..	4	0·2	1½
Jordan, C. H., Kaiapoi, R.M.D. (Line B) ..	6	..	2
Jowers, G. C., Darfield, R.M.D. (Line B) ..	5	..	2
Judson, C. J., High Street, Rangiora (Line C) ..	4	0·3	7
Kelly, D., Willowbridge	5	..	3
King, G. H., West Belt, Rangiora (Line B) ..	4	0·2	6
King, G. H., West Belt, Rangiora (Line C) ..	4	..	1
King, J. C., Box 82, Timaru (Line B)	5	..	2
Lister, T., St. Andrews	4	..	1
Marshall, J. G., "Balraizie," Rakaia	4	..	3
Marshall, S. A., Tycho, R.M.D. (Line A) ..	4	..	2
Martin, F. D., St. Andrews (Line A)	5	..	1
Martin, F. D., St. Andrews (Line B)	5	0·4	1
Martin, W. E., Kaiapoi, R.M.D. (Line A) ..	4	0·2	4
Martin, W. E., Kaiapoi, R.M.D. (Line B) ..	6	..	9
Mehrtens, J. L., Camside, Rangiora	4	1·0	3
Miles, H., Fernside, Rangiora	4	0·2	3
Millar, J. E., Killinchy, via Leeston	4	..	3
Moore, H. S., Box 4, Kaiapoi	4	0·2	9
Morrison, J. L., Morven	4	..	5
Mortland, Mrs. S., Templeton (Line B) ..	4	..	8
Murray, W. J., Spring Creek, Blenheim ..	4	..	1
N.Z. Loan and Mercantile Agency, Ltd., Christchurch (Line F)	6	0·3	4
N.Z. Loan and Mercantile Agency, Ltd., Christchurch (Line G)	4	1·2	2
O'Loughlin, J. (Estate of), St. Andrews ..	5	..	2
Palmer Bros., Rangitata Island	4	..	1
Palmer, R. R., Orari	4	..	2
Parker, F. A., Spring Creek, Blenheim ..	5	..	6
Parry Bros., Southburn, R.M.D.	4	..	1
Parry, J. P., Southburn	4	..	1½
Pearce, Miss J. P., Washdyke	4	..	1
Peterson, B., care of T. S. Gillies, Seadown ..	5	..	3
Pooke, F. J., Pareora	4	..	4
Porter, E., St. Andrews (Line B)	4	..	5
Purvis, G., Oxford Rd., Rangiora (Line A) ..	4	..	3
Rennie, J., Winchester	5	0·4	1
Richards, L., Kingsdown, Timaru (Line A) ..	4	..	1½
Roberts Bros., Cannington, Cave	4	..	1
Rollinson, F. A., and Sons, Studholme Junction ..	4	..	6
Rouse, J. F., St. Andrews (Line B)	4	..	6
Roussell, W. O., Middle Road, Blenheim ..	4	..	2

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
AUCKLANDER SHORT TOP—*continued.*			
Commercial Seed (Canterbury and Marlborough)—continued.			
Salt, A. J., Fairlie	5	..	2
Schluter Bros., Rangiora (Line C)	5	0·2	7
Scott, A., Kerrytown (Line A)	6	1·0	4
Scott, J., Kerrytown	4	0·3	1
Seyb, L., Washdyke (Line A)	5	..	1
Seyb, L., Washdyke (Line B)	4	..	6
Sharlick, J., Marshlands Road, Ouruhia (Line A)	4	0·3	6
Sharlick, J., Marshlands Road, Ouruhia (Line B)	5	..	4
Shillitto, R. S., 135 Armagh Street, Christchurch	4	..	1½
Sievwright, R. M., Washdyke (Line A)	4	..	2
Smith, E. A., Springston, R.M.D.	4	1·3	25
Smith, J. and W., Clarkeville, Kaiapoi, R.M.D.	4	0·5	2
Smith, M., Arowhenua, Temuka	4	..	1
Somerville, H. J. R., Box 44, Timaru (Line C)	5	..	9
Spillane, A., Temuka (Line A)	4	..	1
Tallott, H., Cust	4	1·2	1
Tiffen Bros., Makikihi	4	..	4
Topham, J. W., Arowhenua, Temuka	6	..	3
Topham, W. C., Temuka	5	..	1
Traves, H., Levels	5	0·8	1
Trott and Vincent, Timaru, Waimate, R.M.D.	4	..	1½
Weeber, H., Englefield Road, Belfast, N. 2 (Line A)	4	..	8
Weeber, H., Englefield Road, Belfast, N. 2 (Line B)	4	..	4
Wilson, M. G., Springston, R.M.D. (Line A)	4	1·5	1½
Commercial Seed (Otago and Southland)—			
Carroll, J., North Taieri	6	0·5	1
Penman, A. E., Mosgiel	6	1·0	1
Smith, I. J., Bushey, Palmerston	5	..	1
Suburban Finance Co., Cromwell	6	0·6	1
DAKOTA.			
Mother Seed (Canterbury)—			
Adams, A., Killinchy, via Leeston	6	..	4
Allen, A., Killinchy, via Leeston	4	..	5
Annand, A. R., care of D. McVinnie, Weedons	5	..	4
Amor, A. W., Woodend (Line A)	6	0·2	1½
Barnett, R., Dunsandel (Line A)	5	..	4
Barr, H. C., Springston, R.M.D.	5	..	8
Bishop, W. J., Southbridge	5	..	2
Breakwell, A. J., Tinwald (Line A)	5	..	7
Brodie, R., Rangitata Island (Line B)	6	..	7
Campion, C. A., Mount Hutt, R.M.D., Rakaia (Line A)	6	..	11
Chappell, T., West Coast Road, Yaldhurst	5	..	3
Chatterton, W. V., Dunsandel (Line B)	5	..	1
Cherry Bros., Eyreton, Kaiapoi, R.M.D. (Line A)	5	..	1
Cross, A. E., Bennetts, via Rangiora (Line A)	5	..	1
Crozier, W. J., Mount Hutt, R.M.D., Rakaia (Line B)	5	..	4
Eder, W., Sefton, R.M.D.	5	..	3
Frazer, T., Harewood Road, Christchurch	6	..	4
Frizzell, W., Kirwee	6	..	2
Gardiner, O. J., Dunsandel, R.M.D.	6	..	6
Goodwin, W. J., Rangiora	6	..	1
Hardy, A., jun., Winchmore	5	..	1

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
DAKOTA—*continued.*			
Mother Seed (Canterbury)—continued.			
Harris, V. C., Rangiora	6	..	3
Harrison-Wilke, E. L., Courtenay, R.M.D.	6	..	1½
Johnston, H. W., Box 12, Dunsandel	4	..	10
Johnston, R. H., Dunsandel (Line A)	6	..	2
Lynsky, M., School Road, Yaldhurst	6	..	2
McRobb, A., Mount Hutt, R.M.D., Rakaia (Line B)	5	..	1
McVinnie, D., Christchurch, Greendale, R.M.D.	5	..	2
Mander, H. H., Hawarden	6	..	2
Manson, C. F., Box 2, Coalgate	6	..	2
Marshall, D., Leeston, R.M.D.	5	..	14
Moriarty, L., Southbridge	5	0·2	1½
N.Z. Loan and Mercantile Agency, Ltd., Christchurch (Line D)	6	..	2
N.Z. Loan and Mercantile Agency, Ltd., Christchurch (Line E)	6	..	3
N.Z. Loan and Mercantile Agency, Ltd., Christchurch (Line G)	6	..	3
N.Z. Loan and Mercantile Agency, Ltd., Christchurch (Line H)	5	..	2
Oliver, H. A., Hororata	6	..	1
Oliver, J., Hororata	5	..	1
Orchard, G. B., Cheviot, R.M.D.	5	..	1
Ottley, J., Waimate	5	..	1
Pilkington, R. F., Southbridge	5	..	1
Prosser, Mrs. M. A., Leeston	6	0·3	2
Royds, R. S., 412 Burnside Road, Fendalton, N.W. 1 (Line A)	6	..	5
Shellock Bros., Te Pirita, R.M.D., Rakaia	6	..	7
Skerton, G., Hornby	6	..	4
Smith, E. J., Prebbleton	5	..	5
Somerville, H. J. R., Box 44, Timaru (Line A)	6	..	5
Stewart, A., Marsh's Road, Templeton (Line C)	5	..	5
Tweedy, S., Dunsandel, R.M.D.	6	..	20
Walker, C. E. (Estate of), West Melton, Greendale, R.M.D. (Line A)	5	..	1½
Walker, C. E. (Estate of), West Melton, Greendale, R.M.D. (Line B)	6	..	2½
Wolff, R. G., Horrelville, R.M.D.	6	..	8
Wright, Q. A., Annat	4	..	3
Commercial Seed (Canterbury and Marlborough)—			
Alexandre, H., Belfast	8	..	6
Amor, A. W., Woodend (Line C)	8	..	2
Anderson, A., "Crofthead," Southbridge	8	..	14
Ashwell, L., Greendale, R.M.D.	8	..	8
Barnes, C. F., Cheviot, R.M.D.	8	..	2
Beer, G. F., Horrelville, R.M.D.	8	..	4
Bowie, J. H., Otaio	7	..	2
Breading, A. J., Te Pirita, R.M.D., Rakaia	8	..	3
Breakwell, A. J., Tinwald (Line C)	7	..	5
Brodie, R., Rangitata Island (Line A)	7	..	7
Brodie, R., Rangitata Island (Line D)	8	..	1½
Brown G. E., Kaiapoi, R.M.D.	7	..	3
Burns, R. A. C., Te Pirita, R.M.D., Rakaia	7	..	4
Burrowes, J., Chertsey (Line B)	7	..	2
Campion, C. A., Mount Hutt, R.M.D., Rakaia (Line B)	7	..	1

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
DAKOTA—*continued.*			
Commercial Seed (Canterbury and Marlborough)—continued.			
Chalmers, G. C., Rangitata	9	..	3
Chatterton, W. V., Dunsandel (Line A)	7	..	5
Cherry Bros., Eyreton, Kaiapoi, R.M.D. (Line B)	7	..	2
Connell, M., Arowhenua, Temuka	7	..	3
Cross, A. E., Bennetts, via Rangiora (Line B)	8	..	1½
Cross, H. E., Sandy Knolls	7	..	1
Crozier, W. J., Mount Hutt, R.M.D., Rakaia (Line A)	9	..	4
Curtis, J. J., Yaldhurst	8	..	1
Dowdle, T. S., Prebbleton	7	..	1½
Dunlop, W. N. G., Courtenay, Greendale, R.M.D.	9	..	2
Everest, W., care of J. Crozier, Crozier's Road, Christchurch	9	..	1
Fairbairn, J., Springston, R.M.D.	9	..	3
Fine, G. H., 57 Spring's Road, Sockburn (Line A)	8	..	6
Foster, T. C., Springston, R.M.D.	7	..	10
Fowler, G. H., Halkett, R.M.D.	9	..	3
Fowler, J. A., Hillersden, Marlborough	9	..	2
Fraser, J., Woodend	8	..	4
Gardiner, C., care of O. J. Gardiner, Dunsandel, R.M.D.	9	..	2
Giles, N., Seadown, Timaru	9	..	3
Gimson, W., Mitcham, via Rakaia	9	..	4
Harris and Aschen, care of H. Aschen, Ashburton Forks (Line A)	9	..	2
Harris and Aschen, care of H. Aschen, Ashburton Forks (Line B)	9	..	2
Harvey, W., Willowby, Ashburton	9	..	2
Hennessey, W., Mitcham, via Rakaia (Line A)	9	..	1
Hennessey, W., Mitcham, via Rakaia (Line B)	9	..	1
Hooper, R. M., Mitcham, via Rakaia	8	..	4
Johnston, K. A., Selwyn	9	..	2
Johnston, R. H., Dunsandel (Line B)	8	..	1
Jowers, G. C., Darfield, R.M.D. (Line B)	9	..	1
Leslie, W. J., Hornby	8	..	2
McCartin, J., Leeston, R.M.D. (Line A)	9	..	12
McDermott, E. C., 25 Tankerville Street, Christchurch, S.W. 2	7	..	7
Moore, H. S., Box 4, Kaiapoi (Line A)	8	..	3
Moorhead Bros., Southbridge, R.M.D. (Line A)	8	..	11
Moorhead Bros., Southbridge, R.M.D. (Line B)	9	..	10
Moorhead Bros., Southbridge, R.M.D. (Line C)	9	..	25
N.Z. Loan and Mercantile Agency, Ltd., Christchurch (Line F)	8	..	2
Oakley, L. O., Rakaia	9	..	1
Orbell, W. H., Levels	7	..	1
Palmer Bros., Rangitata Island	8	..	2
Palmer, R. R., Orari	8	..	2
Payne, J., Yaldhurst, Greendale, R.M.D. (Line A)	9	..	15
Peach, J., Sefton, R.M.D.	9	..	1
Phillips, A., Weedons, Springston, R.M.D.	9	..	8
Phillips, A. G., Weedons, Springston, R.M.D. (Line C)	8	..	2
Prebble, R. W., Halkett, R.M.D.	8	..	1½
Robinson, R. G., Ltd., Box 4, Papanui	7	..	1
Robson, F. H., Box 22, Lincoln	8	..	5
Royds, R. S., 412 Burnside Road, Fendalton, N.W. 1 (Line B)	8	0·1	3

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
DAKOTA—*continued.*			
Commercial Seed (Canterbury and Marlborough)—continued.			
Ryan, P. F., Springs, Weedons, R.M.D.	9	..	20
Shellock, W., Te Pirita, R.M.D., Rakaia	7	..	5
Somerville, H. J. R., Box 44, Timaru (Line B)	8	..	4
Stevenson, T. J., Rakaia	7	..	1
Swanson, W., Selwyn	8	..	2
Tallott, E. D., Cust	8	..	1½
Thomas, C. B., Springston, R.M.D.	8	..	8
Upston, E. E., Selwyn	8	..	12
Watson, M. E. M., Dunsandel	8	..	7
Ward, R. R., Hook	7	..	2
Wilkinson, V., Mitcham, via Rakaia	8	..	5
Williams, J. W., Whincops Road, Halswell	8	..	3
Wilson Bros., Halkett, R.M.D.	9	..	3
Wilson, M., Halkett, R.M.D.	8	..	6
ARRAN CHIEF.			
Mother Seed (Canterbury)—			
Barnes, R., John's Road Belfast	4	0·7	1½
Barnes, W., and Son, 199 Highsted Road, Styx	4	0·4	5
Blair, C., Willowbridge	3	..	2
Boyce, W. J., Waituna, Waimate	3	..	2
Campbell, P., Studholme Junction (Line A)	4	..	3
Cox, S., Willowbridge	3	..	4
Faulkner, J. C., Willowbridge (Line B)	3	..	2
Fletcher, W. J., "Hopefields," Willowbridge	4	..	8
Foley, T. F., Waituna, Waimate	3	..	1
Forsyth, J., Willowbridge (Line A)	3	0·5	2
Forsyth, J., Willowbridge (Line C)	4	..	1½
Hayman, A. B., Studholme Junction	3	..	3
Hayman, T. L. and A. F., Studholme Junction (Line B)	4	..	2
Henshaw, F. J., Studholme Junction (Line B)	3	..	5
Hewson, R. H., Seadown P.O.	3	..	2
Kelly, D., Willowbridge (Line A)	4	0·5	3
Lindsay, J., Studholme Junction (Line A)	4	0·5	3
Lindsay, J., Studholme Junction (Line B)	3	..	2
Meynell, T. W., Waimate	4	..	2
Moore, H. S., Box 4, Kaiapoi (Line A)	4	0·2	6
Moore, H. S., Box 4, Kaiapoi (Line B)	4	0·1	4
Paul, A., Waimate (Line A)	3	..	1½
Rollinson, F. A., and Sons, Studholme Junction (Line B)	3	..	6
Wilson, E. R., Waimate (Line A)	3	..	2
Wright, L. T., Annat	3	0·7	8
Mother Seed (Otago and Southland)—			
Anderson, A., Stirling (Line B)	4	..	1½
Birse, J. W., Te Wae Wae	3	..	2
Bruce, J. A., Otahuti, R.M.D., Invercargill	3	..	3
Corkery, J., Te Wae Wae	2	..	1
Daly, P. G., Te Wae Wae	3	..	3
Dobbie, R., Menzies Ferry	4	0·2	2
Griffin, G., Te Wae Wae	4	..	2
Griffin, J. G., Te Wae Wae	2	..	4
Hamilton, G., Tuatapere, R.M.D.	2	0·2	3
Knowler, H., sen., Te Wae Wae	2	1·0	5
Lobb, J. H., Tuatapere	4	..	1
Sim, A. R., Pikopiko, Tuatapere	2	..	1
Skinner, J. L., North Taieri (Line A)	3	0·2	1

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
DAKOTA—*continued.*			
Commercial Seed (Canterbury)—			
Barclay, G. M. M., Riverlands, Waimate ..	6	..	16
Batchelor, R. S., Waimate	6	1·5	2
Hayman, T. L., and A. F., Studholme Junction (Line A)	5	0·2	6
Henshaw, F. J., Studholme Junction (Line A) ..	6	1·0	6
Judson, C. J., High Street, Rangiora	6	0·2	7
Kelly, D., Willowbridge (Line B)	5	0·6	16
Kelly, D., Willowbridge (Line D)	6	0·3	7
Kelly, D., Willowbridge (Line E)	7	1·7	30
McDonald, M., Allan Street, Waimate ..	5	1·2	2
Meredith, R. J., Waimate	6	..	1
Meyer Bros., Waimate	7	0·2	2
Morris, M. J., Willowbridge (Line A)	5	0·7	3
Murphy, M., Morven	7	0·6	5
Paul, A., Waimate (Line B)	6	..	5
Rollinson, F. A., and Sons, Studholme Junction (Line A)	6	..	10
Saunders, E. E., Studholme Junction (Line A) ..	7	..	7
Saunders, E. E., Studholme Junction (Line B) ..	6	..	3
Wilson, E. R., Waimate (Line B)	5	..	9
Commercial Seed (Otago and Southland)—			
Anderson, A., Stirling (Line A)	6	..	3
Beckingsale, J. H., Herbert	7	..	1
Bell, J. F., Stirling	6	0·2	4
Forde Bros., Te Tua	5	1·8	2
Harvey, W., Mosgiel (Line A)	6	..	2
Harvey, W., Mosgiel (Line B)	6	1·2	2
Hurst, S. M., Papakaio	7	0·7	1
Jensen, A. A., Stirling	5	..	1
Knowler, C. E., Box 97, Tuatapere	5	0·2	4
Knowler, H. C., jun., Te Wae Wae	5	0·8	4
Orbell, A., Waikouaiti	6	..	1½
Skinner, J. L., North Taieri (Line B)	5	1·9	1
Smith, I. J., Bushey, Palmerston	6	0·2	2
KING EDWARD.			
Mother Seed (Canterbury)—			
Bisdee, J. C., Clandeboye, Temuka	4	..	1½
Guthrie, A., Orari	4	..	1½
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2 (Line A)	3	0·2	2
Mother Seed (Otago and Southland)—			
Arthur, W., Box 16, Tuatapere	4	0·8	2
Bennett, J. J., Tuatapere, R.M.D.	2	..	1
Bennett, J., jun., Tuatapere, R.M.D.	2	0·4	8
Birse, J. W., Te Wae Wae	2	..	1
Blakie, L., Section 1, Otahuti, R.M.D., Invercargill	4	..	1
Bruce, J. A., Section 2, Otahuti, R.M.D., Invercargill	3	..	1½
Burgess, D., West Plains, R.M.D., Invercargill ..	3	..	1
Clark Bros., Ryal Bush	4	..	1
Corkery, J., Te Wae Wae	2	..	1
Forde Bros., Te Tua	3	0·2	2
Free, A. T., Outram	4	..	5

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
KING EDWARD—*continued.*			
Mother Seed (Otago and Southland)—continued.			
Griffin, G., Te Wae Wae	2	..	3
Griffin, J. G., Te Wae Wae	3	..	2
Hamilton, G., Tuatapere, R.M.D.	4	..	3
Imrie, J. M., Mosgiel (Line A)	4	..	2
Jenkins, G. R., Tuatapere	3	..	2
Knowler, H. C., jun., Te Wae Wae	4	..	1
Ledington, F., Lochiel	3	..	1
Lobb, J. H., Tuatapere	3	..	1
Milburn, M., Wright's Bush, R.M.D., Invercargill	2	..	2
Myron, A., Ryal Bush	3	..	2
Norman, H. D., Tuatapere	4	0·2	4
Paulin, T. G., Outram	4	..	1½
Read, J. G., Mosgiel	4	..	1
Ryan, P., and Son, Gorge Road, Southland ..	4	..	1½
Sheddan, G. B., Section 2, Otahuti, R.M.D., Invercargill	3	..	1
Skinner, J. L., North Taieri	3	..	1½
Stiven, J. E., Paretai, R.M.D., Balclutha ..	3	..	1
Taylor, W. G., Mosgiel	4	..	1
Throp, O. R., Te Houka, Balclutha	4	..	2
Wilson, C. H., Lorneville, Invercargill	3	..	1½
Commercial Seed (Canterbury)—			
Bird, A. M., Waimate	5	.	2
Commercial Seed (Otago and Southland)—			
Anderson, A., Stirling	6	..	3
Graham, J. W., Mosgiel (Line A)	5	..	4
Gray, J. S., Frankton	5	..	1
Kirk, R., Tapanui	5	..	1
Smith, G. C., Deborah, R.M.D.	6	..	1
Thornton, A. F., Momona	5	..	2
Thornton, F. J., Momona	5	..	4
Thornton, J. W., Momona	5	..	5
Waite, A., Tapanui	5	..	1
Weir, J. G., Stirling	5	..	3
INVERNESS FAVOURITE.			
Mother Seed (Canterbury)—			
Adams, A. A., Annat	3	..	1
Atkinson, R. J., Annat	2	..	3
Barclay, G. M. M., Riverlands, Waimate ..	2	..	2
Breakwell, A. J., Tinwald	2	..	2
Hanna, M., Sefton	3	..	4
Harris, V. C., Rangiora (Line A)	3	..	4
Hurley, H., jun., Balcairn	2	..	4
Kelcher, F. M., Balcairn	3	..	2
Lewis, E. D., Sefton, R.M.D.	1	..	4
Lowe, G. J., Coldstream, Rangiora	2	..	2
Macdonald, R., Annat	1	..	10
Mehrtens, J. L., Camside, Rangiora	2	..	3
Payne, A. E., Springston, R.M.D.	3	..	2
Peach, J., Sefton	3	..	1
Petrie, J., jun., Swannanoa	2	..	1½
Piner, E., Annat, R.M.D.	1	..	2
Commercial Seed (Canterbury)—			
Chetnole Ltd., Glenavy	4	0·1	15
Rose, C. F., Hook, R.M.D.	4	..	7
Somerville, H. J. R., Box 44, Timaru	4	..	2

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
INVERNESS FAVOURITE—*continued.*			
Commercial Seed (Otago and Southland)—			
Graham, J. W., Mosgiel	4	..	1
Smith, I. J., Bushey, Palmerston	4	..	1
AUCKLANDER TALL TOP.			
Mother Seed (Canterbury)—			
Bailey, J., Kaiapoi, R.M.D.	3	..	8
Bonnett, N. M., Rangiora	3	..	3
Frost, C. H., Balcairn	3	..	2
Guy, T. A., and E. B., Courtenay, R.M.D.	1	..	6
Hardy, A., jun., Winchmore, R.M.D.	3	..	1
Hardy, G., Winchmore, R.M.D.	3	..	2
Harrison-Wilke, E. L., Courtenay, R.M.D.	2	..	1
Judson, C. J., High Street, Rangiora	3	..	15
Minchington, F. W., Fernside	3	..	3
N.Z. Loan and Mercantile Agency, Ltd., Christchurch	2	..	1½
Oliver, J., Hororata	1	..	4
Roper, R. S., Halkett, R.M.D.	3	0·8	3
Steele and Dawson, care of F. Steele, Fernside (Line A)	1	..	10
Steele and Dawson, care of F. Steele, Fernside (Line B)	3	..	3
Commercial Seed (Canterbury)—			
Breakwell, A. J., Tinwald	4	0·2	3
Ellis, M. G., Kingsdown, Timaru	4	..	1½
Fell, E. T., Otipua, R.M.D.	5	..	4
Rangiora High School, Rangiora	4	..	5
Seyb, L., Washdyke	5	..	4
Simmons, W., Kingsdown, Timaru	4	..	1½
ARRAN BANNER.			
Mother Seed (Canterbury)—			
Leathwick, A., Hunter, R.M.D.	4	..	2
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2	3	0·5	4
Simmons, W., Kingsdown, Timaru	4	..	2
White, R. Y., 402 North Road, Styx	3	..	2
Mother Seed (Southland)—			
Knowler, H., sen., Te Wae Wae	4	0·2	1
Commercial Seed (Canterbury)—			
Amyes, H. C., "Riversleigh," Annat, R.M.D.	5	..	5
Robinson, R. G., Ltd., Box 4, Papanui (Line A)	6	..	3
Robinson, R. G., Ltd., Box 4, Papanui (Line B)	5	..	4
Steele and Dawson, care of F. Steele, Fernside	5	..	2
Commercial Seed (Otago)—			
Smith, G. C., Deborah, R.M.D.	6	..	1
EPICURE.			
Mother Seed (Canterbury)—			
Hobday, J. H., 33 John Street, Papanui	4	0·2	3
Macdonald, R., Annat	4	..	5
Marshall, D., Killinchy, Leeston, R.M.D.	5	..	5
Shellock Bros., Te Pirita, R.M.D., Rakaia (Line A)	4	..	1
Wright, L. T., Annat	4	..	2
Wright, Q. A., Annat	4	.	1

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
EPICURE—*continued.*			
Mother Seed (Southland)—			
Burgess, D., West Plains, R.M.D., Invercargill ..	5	..	1
Commercial Seed (Canterbury)—			
Spillane, A., Temuka	6	..	1
Commercial Seed (Otago and Southland)—			
Kirk, R., Tapanui	6	..	1
Middlemiss and Burnby, East Chatton ..	6	..	1
AMERICAN WONDER.			
Mother Seed (Canterbury)—			
Cox, N., 238 Wairarapa Road, Christchurch ..	4	..	1
Franks, W. T., 103 Gray's Road, Upper Fendalton	5	..	2
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2	5	..	2
Commercial Seed (Canterbury)—			
McPhail, W. A., Mitcham, via Rakaia ..	7	..	1
Shellock, W., Te Pirita, R.M.D., Rakaia ..	7	..	1
IRON DUKE.			
Commercial Seed (Canterbury)—			
Croft, R., "Glenlea," Amberley (Line A) ..	7	..	1½
Croft, R., "Glenlea," Amberley (Line B) ..	8	..	4
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2 (Line A)	6	..	4
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2 (Line C)	7	0·2	2
Commercial Seed (Otago)—			
Grant, G. B., Puerua, Otago	6	..	3
JERSEY BENNES.			
Mother Seed (Canterbury)—			
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2	5	..	2
Mother Seed (Southland)—			
Burgess, D., West Plains, R.M.D., Invercargill ..	5	..	3
Commercial Seed (Canterbury)—			
Annand and Co., A. B., Timaru	6	..	1
Commercial Seed (Otago)—			
Graham, J. W., Mosgiel	7	..	1½
McGregor, A., Factory Road, Mosgiel	7	..	2
EARLY REGENT BOLTER.			
Commercial Seed (Canterbury)—			
Caldwell, G. D., 165 Russley Road, Upper Fendalton	6	..	1
Oakley, W., Hororata	6	..	5
Wilson, M., Halkett, R.M.D.	7	..	2
EARLY ROSE.			
Mother Seed (Canterbury)—			
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2 (Line A)	3	..	2
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2 (Line B)	4	..	2
Shellock Bros., Te Pirita, R.M.D., Rakaia ..	3	..	2

LIST OF GROWERS—*continued.*

Name and Address.	Group No.	Percentage of Foreign Varieties.	Area in Acres.
MAJESTIC.			
Mother Seed (Canterbury)—			
Crozier, W. J., Mount Hutt, R.M.D., Rakaia ..	6	..	6
Hobday, J. H., 33 John Street, Papanui ..	5	..	3
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2 (Line B)	4	..	3
UP TO DATE.			
Commercial Seed (Canterbury)—			
Robinson, R. G., Ltd., Box 4, Papanui ..	6	..	1
Somerville, H. J. R., Box 44, Timaru	6	..	3
Commercial Seed (Otago)—			
Sanders, W. M., Rockford, Clinton	6	..	2
ARRAN CONSUL.			
Mother Seed (Canterbury)—			
Macdonald, R., Annat	3	0·5	5
Robinson, R. G., Ltd., Box 4, Papanui ..	4	0·2	2
CLIFFS KIDNEY.			
Mother Seed (Canterbury)—			
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2 (Line A)	5	0·3	4
Penn, T. A., 27 Norman's Road, Christchurch, N.W. 2 (Line B)	4	..	1½
GREAT SCOT.			
Mother Seed (Canterbury)—			
Robinson, R. G., Ltd., Box 4, Papanui ..	4	0·2	2
Commercial Seed (Canterbury)—			
Wright, L. T., Annat	5	1·3	2
MAORI CHIEF.			
Mother Seed (Canterbury)—			
Robinson, R. G., Ltd., Box 4, Papanui ..	3	..	4
ROBIN ADAIR.			
Mother Seed (Canterbury)—			
Robinson, R. G., Ltd., Box 4, Papanui (Line C)	5	..	1
SIR J. G. WILSON.			
Mother Seed (Canterbury)—			
Robinson, R. G., Ltd., Box 4, Papanui ..	3	..	2

—*Fields Division.*

Field trials and farming experience have again emphasized the enormous value to New Zealand of "strain" in grasses and clovers as a factor to progress. Reports from the South Island from even the most arable districts are extremely encouraging, particularly from the point of view of the rye-grass strain used. New Zealand certified strains are being increasingly demanded. Plot-trial, field-trial, and farm-scale experience is also emphasizing the value of the New Zealand No. 1 white-clover type, and this fairly bids to rival certified perennial rye-grass in importance viewed from the point of view of strain.—*Report, Agrostologist.*

SEASONAL NOTES.

THE FARM.

The Problem of Inferior Composition of Pastures.

THERE is evidence in the main grass-farming districts of a tendency on the part of both dairy-farmers and sheep-farmers to continue using swards composed of inferior plants when it would be relatively easy and distinctly profitable to replace them with swards consisting largely of more productive pasture-plants. This is particularly true of the many farms on which it is customary to experience shortage of feed at one or both of the critical seasons of low direct production of pastures—*i.e.*, the late-winter and early-spring period and the late-summer period.

There are three basic facts in this matter. In the first place there are inferior pastures of which economic improvement is or at least is considered to be impossible in the light of our present knowledge. Secondly, such pastures are not at all as numerous as many seem to believe, and additions to our experience are periodically making them less numerous; for instance, the use of subterranean clover makes it possible to improve remarkably certain poor pastures, whereas payable means of improving these pastures without using subterranean clover are not known. Thirdly, after making full allowance for the dwindling number of pastures which we do not know how to improve economically we have thousands of pastures which can be improved profitably by one or more of the following practices: top-dressing, surface-sowing of seed, and resowing on a cultivated seed-bed.

While poor pastures can often be improved substantially by suitable top-dressing, it should be borne in mind not only that the repairing of pastures by top-dressing alone is usually a relatively slow process, but also that the amount of improvement possible under normal management depends to a large extent upon the plants which are present at the outset, and, because of this, at times it is not as great as is desirable.

In certain circumstances which are not at all uncommon the surface-sowing of suitable seed in combination with appropriate top-dressing gives much greater and quicker improvement than could be obtained by top-dressing alone. Surface-sowing of two distinct types has on occasions been carried out successfully on poor pastures. Firstly, there has been the use of a mixture designed to give a good mixed permanent pasture; of this the total experience is not extensive, and, further, failures from such surface-sowing must be viewed as a possibility. Secondly, especially in recent years, surface-sowing has often been confined exclusively to the use of subterranean clover, and this in quite a satisfactory percentage of cases has been attended with distinct success when the pastures have been so open at the time of surface-sowing that the seedlings of subterranean have been able to establish themselves without the competition for a foothold in the soil and for a supply of sunlight which they have to face in dense swards, say, of brown-top, for instance, on which surface-sowing has been far from uniformly successful.

By the foregoing statements it is intended to indicate that top-dressing, or top-dressing in combination with surface-sowing, at best is a somewhat uncertain or imperfect means of improving poor pastures. Hence, frequently the case for the renewal instead of the repairing of poor pastures is a strong one. The repairing process, however, may be the best course when the farmer is handicapped in regard to finance or labour or when all the equipment to be used in the work of repairing would have to be purchased. Again, the repair of pastures may be the only possible course, as, for instance, when the land is rough or timbered or when the soil is so light and subject to wind that the danger of erosion forbids cultivation.

The improvement of pastures by resowing after an arable period not only can be carried out quickly, but also makes it possible to take advantage of recent advances in regard to strain differences within pasture species. Hence the improvement often may be made a double-feature one—the sowing of more valuable species such as rye-grass, cocksfoot, and clovers in place of brown-top, rib-grass, catsear, &c., can be linked with the use of the better strains that were not readily procurable when the pasture, if an old one, was previously sown down. The official system of seed certification has resulted in a dependable supply of such strains. When improvement of a pasture by renewal is being considered, it should be kept in mind that while lack of fertility is not always the cause of inferior pastures it frequently is so. If a pasture is inferior because of the lack of fertility under which it exists, then it is of prime practical importance to bear in mind that the mere sowing of seed fitted to give a good pasture will not necessarily give such a pasture; if improved fertility by means of such practices as top-dressing and drainage is needed, then, until the fertility is suitably improved, the sowing of good seed will prove futile to a considerable extent. In practice this seems sometimes to be completely overlooked. For instance, a pasture which is of low production and poor composition is broken up and arable crops which impoverish the land are grown before the area is again sown in grass. Really in such circumstances it is unreasonable to expect an improved permanent pasture until the fertility is made greater than it was prior to the impoverishment by the exhausting crops. It follows that in the circumstances cited any cropping prior to the sowing of the permanent pasture should be fitted to increase instead of to exhaust the fertility of the soil. This common-sense course is reversed in those numerous cases in which such crops as oats, maize, and millet precede permanent pasture in land the fertility of which prior to these crops tends to be inadequate for the type of pasture it is desired to obtain; the crops named and similar ones in general reduce fertility, especially when they are not consumed where they are grown. If land is worn out to some extent by cropping prior to the sowing of permanent pasture, then a liberal fertilizing of the young pasture in its early stages becomes particularly advisable.

July Top-dressing.

Extensive field experience has taught that top-dressing, if not already done, may be carried out with good results in July. In many of the main dairying districts, even in the case of wet relatively cold soils, superphosphate applied in July may be expected to bring about useful increases in the amount of feed available directly from the pastures in August. When speedy benefit from top-dressing is desired, as it usually is, then superphosphate ordinarily should be used, and in districts in which liming is profitable lime should be applied shortly before or at the same time as the superphosphate if benefit from a previous liming is not still being obtained.

On many occasions in these notes the application to grassland of superphosphate and of other phosphates much earlier in the year has been recommended. That recommendation continues, but many who have not top-dressed or not top-dressed enough prior to winter would be wiser to do it in July or thereabouts than to do no further top-dressing during this year.

If the weather conditions do not lead to an unusually late commencement of increased growth-rate of grass in the new season, then the application of sulphate of ammonia or similar nitrogenous fertilizer about mid-July to suitable pastures may be expected to result in a substantial increase in the feed available from treated fields in August and September, but for a few weeks prior to mid-July it is usually inadvisable to apply such nitrogenous fertilizer. As a general rule superphosphate should be used in conjunction with sulphate of ammonia. Whether sulphate of ammonia or similar

nitrogenous manures should be used in the manner just specified is determined to a considerable extent by how acutely additional early feed is needed. A further question likely to arise is whether the necessary additional feed could be obtained more cheaply than by the use of a quickly acting nitrogenous fertilizer.

Harrowing and Spelling of Pastures.

Harrowing of pastures usually calls for widespread attention in July, when it is particularly advisable to break up and distribute thoroughly droppings on fields which have been heavily stocked during May and June. To bring about thorough distribution a section of chain-harrow attached behind the grass-harrow generally proves of value.

As a means of avoiding early setbacks it is very desirable to have attractive suitable feed available for early-calving cows and for early-lambing ewes. To provide such feed it often is very advisable to shut up in July suitable pastures, preferably ones which are well drained and sheltered and in which rye-grass is prominent. An immediate top-dressing of such pastures with superphosphate, if they have not been top-dressed prior to winter, is likely to be of assistance.

Trampling of wet soft paddocks leads not only to direct loss of valuable plants by burial, but also to the possibility of the establishment of such weeds as thistles, docks, rushes, buttercups, and daisies on the bare surface soil which results from the burial of valuable components of the pasture. Among the main ways of reducing the damage from trampling to a minimum are—(1) The stocking of wet areas as little as possible; (2) the feeding-out of hay, &c., on the drier portions of the farm, which often are the poorer portions that benefit most greatly from the increased fertility that feeding-out gives; (3) the feeding-out of hay, &c., on the poorer pastures which are soon to be put to arable use.

Arable Cropping.

As a rule, the sowing of seed in July in inadvisable. Hence if wheat cannot be sown by about mid-June the sowing usually may with advantage be deferred until August, unless the doing of this seems likely to lead to a subsequent embarrassing rush of work.

Every opportunity should be taken to go ahead with cultivation in preparation for the spring sowing of cereals, mainly in the August–September period, but the harm to the tilth of the soil which results from the tillage of heavy wet soils should be avoided.

As a means to more profitable feeding of stock, two crops which, having regard to their merits, are much neglected are lucerne and mangels. The 1935–36 Dominion acreage of mangels was considerably above the average acreage for the ten years ending at the 1935–36 season; definite figures are not yet available relative to the 1936–37 acreage, but reports from seed-merchants suggest an appreciable decline. A decline is directly contrary to the needs of the position unless other feed to replace that yielded by the mangel is being provided, but of this there is no evidence. It has been stated that recent changes in the farm-labour position are adversely affecting the area devoted to arable crops generally, but especially that devoted to the mangel. In this connection it should be remembered that the well-managed highly productive mangel crop can remain distinctly profitable when loaded with labour charges great enough to make many other crops unprofitable. Mangel crops of 60 tons an acre or more are so common that it is clear that when conditions are suitable for mangels a 60-ton-an-acre crop is not an exceptional achievement. When hay is worth £3 a ton, then mangels are worth at least 10s. a ton, so that the value of a 60-ton crop is £30 an acre—a value which after allowing for other charges leaves a substantial sum for labour costs.

The outstanding value of lucerne has been demonstrated convincingly by farm results in many districts. New Zealand experience confirms that of other countries in that it shows what a definite misconception it is to believe

that lucerne is particularly exacting in its requirements: it has been found in New Zealand that lucerne succeeds on practically all types of naturally well-drained soil, and that there is a profitable role for lucerne at least whenever a dry summer spell causing a shortage of green non-stemmy feed from pastures is expected fairly frequently.

Lucerne may with advantage follow old pasture, and if it does so, then the land should be skim-ploughed well ahead of the time of seeding, and subsequently ploughed deeply once only. Detailed guidance regarding lucerne-culture is contained in this Department's Bulletin 155, available for free distribution.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Planting.

THE planting of trees may be carried out where the land is in a suitable condition and well drained. If the land is not in suitable condition planting should be delayed until the spring, when the ground has become reasonably dry and warm. This is in order that the trees may quickly establish their roots in their new position in which they are placed in the orchard.

The correct depth of planting is very important. Trees require to be planted at a depth of 2 in. to 3 in. greater than they were in the nursery. If they are planted too deeply they will not do well, and if they are too shallow they are liable to be blown over, and to suffer root injury when the land is being worked.

Cultivation.

Ploughing may be carried out where the land is in a suitable condition, and should be completed as early as possible. A depth ranging from 3 in. to 8 in., according to the age of the trees and the depth of the roots, is usually sufficient to turn in and cover the weeds and other volunteer growth and cover-crop. Close up to the trees the depth of the ploughing should not be greater than 3 in. to 4 in.

Maintenance of Plant.

During the winter months advantage should be taken of wet days to clean, oil, and repair or paint implements, tools, harness, &c. The spray-pump should be the first to receive attention, and the whole outfit should be thoroughly overhauled and put in good working-order. In localities subject to heavy frosts no liquid should be left in the pump, otherwise it may be seriously damaged, with the result that spring spraying will be delayed and may have to be omitted altogether, to the detriment of the trees and subsequent crops. Hares and rabbits cause considerable damage to young trees in many localities at this time of the year: in a single night large numbers of trees have been ruined by these pests. In localities where they are present the orchard should be netted. All netting fences should be examined carefully, and any holes which may be found should be repaired at once. Clear all hares or rabbits from the orchard. Where netting is not provided the trunks and lower branches of the trees should be painted with "Stockholm" tar, which has proved an effective deterrent of the attacks of these pests, and this without injury to the bark. It is not advisable to paint it on the buds. "Stockholm" tar is not liable to cause injury to the trees, but there is a probability of damage if trees are painted with coal tar.

Fruit in Storage.

Fruit in cool and ordinary storage should now be examined at frequent intervals. Much loss has been suffered by orchardists because of neglect in this direction. Apples should be disposed of while sound and in good condition, and before they show any signs of wilting or before they become over-ripe. Over-mature fruit will not stand the handling that freshly

picked fruit will do, and such fruit frequently arrives on the market in an unsaleable condition. Pears should be disposed of before they become too yellow and ripe. All stored fruit should be repacked before it is placed on the market.

Pruning of Apples.

When planting a young apple-tree, of no matter what variety, always remove the centre-leader. Choose well-grown yearling or two-year old trees from a reliable nurseryman and see that they are free from all disease. The main stem should be short and not more than 18 in. high. Select three well-placed arms starting from different portions of the main stem at a wide angle if possible, and remove all others. Shorten the three arms back to three or four buds, pruning to side buds which will throw the shoots in the required direction, the object being to form a wide stout base of main arms upon which to build the future tree; these main arms jointing at different parts round the trunk give a very strong base. In the second year's pruning the trees are again pruned, about 9 in. to 1 ft. being left, and a well-placed fork being obtained by pruning to suitable side buds will give six leaders. Remove all but a few laterals from the inside of the tree, also thin out any excess of laterals on the outside of the limbs, and slightly shorten back those left.

In the third winter's pruning, prune fairly hard, leaving up to 18 in. on each leader, and cutting to a well-placed side bud on each, which will now give twelve leaders.

After the third year we have to consider future crops of fruit and vary the pruning practice so as to throw the tree into bearing. This must be done gradually, as the young tree must not be exhausted by being made to bear heavy crops, but should be gradually brought into full bearing as it approaches and reaches the age of eight or ten years, according to variety. The object is to maintain a strong, healthy, and vigorous low-set tree, capable of bearing regular and heavy crops of fruit from base upwards on the framework or leaders established, without any breaking-down of the limbs or stunting of the tree, this framework being so well spaced as to allow plenty of room between each leader, and the centre of the tree being kept as well open as the variety and climatic condition require, all the main and secondary arms being at an angle and not upright to the trunk. The fruiting wood or spurs should be built up gradually each year on all varieties of trees.

Sturmer and other varieties that spur freely are usually heavy croppers, but some of the laterals should be left long-pruned to make fresh fruiting-wood to take the place of the worn-out fruiting-spurs. The spurs so increase and multiply as the tree ages that it is necessary to thin them heavily, otherwise they rob each other, the flowers become weak and sterile, and the tree does not set its crop well. In addition to thinning out fruit-spurs and shortening some of the laterals, it is necessary to prune the leader-growth back to from 6 in. to 9 in. to enable the tree to make good sturdy lateral growth, otherwise it may become stunted.

Jonathan, Cox's Orange, and other varieties that fruit mainly on laterals and do not readily produce fruit-spurs require more skill in pruning than do the free spur-bearing varieties. It is very often necessary to prune these varieties to inside buds on the leader growth or to an upright lateral to prevent the trees from spreading too much. The laterals (and leaders) should be shortened only to good stout buds, as the two first are often blind. The leaders require to be kept well spaced and should not be allowed to overcrowd each other. As soon as the required number of leaders—*i.e.*, eight to twelve—have been obtained, they are not again forked or branched in pruning but are kept intact right through, the extremities being kept clean of all lateral growths so as to ensure a strong vigorous growth. This process is continued each year, and the laterals kept healthy, strong, and productive by shortening in after they form fruit-buds. Any laterals that have been left unpruned must be shortened in the following year, more

especially the longer ones, not only because the trees will overbear, but each lateral will soon become barren near its base instead of increasing and multiplying.

Rome Beauty and Irish Peach varieties are somewhat difficult to bring into bearing and keep healthy and vigorous. In their young stages they are very vigorous, but if not treated correctly are inclined to stunt and show too much bare wood.

The short laterals should not be touched, but the longer ones should be both winter and summer pruned. By judicious summer pruning or pinching of the laterals they may be made to spur readily.

The best results of summer pruning are obtained by shortening the long lateral growths back to five or seven buds during the months of February or March. If cut back too early they are inclined to break into growth instead of forming fruit-buds. If summer pruning is continued for several years, both of these varieties will eventually become more or less spur-bearers, instead of carrying their fruit only at the extremities of the laterals.

—B. G. Goodwin, Orchard Instructor, Christchurch.

Citrus Culture.

Picking is the chief work in the grove during the next few months. The matter of the careful handling of citrus fruits in all stages from the tree, through the curing and packing rooms, and on to the consumer, is one which leaves so much room for improvement that no apology is offered for again bringing it prominently under notice. The subject was dealt with in the notes appearing in the issues of the *Journal* for May and February last, and the reader is urged to look over these and apply the suggestions therein to his grove whenever consistent with the work in hand.

During harvesting it often happens that failure to control disease in the earlier part of the season is brought very forcibly under the notice of the grower in the shape of a large percentage of diseased or blemished fruit. The former, of course, must not be sold, while the latter may be marketed only under one or other of the lower-grade marks such as "Good" or "X" grade. It may be said with some truth that the percentage of "reject" fruit produced is an indication of the efficiency of the management of an orchard. An analysis of the cause of the blemish on the low-grade fruit will show that while some types of injury are difficult to avoid, others can be eliminated by spraying, a good instance of the latter being thrips injury.

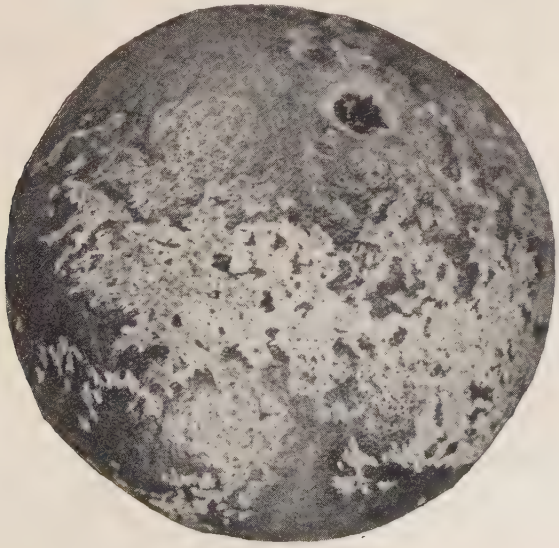

FIG. 1. SEVERE INJURY TO SKIN OF ORANGE DUE TO THRIPS.

It is evident that the control of thrips has often been neglected in the past, but now that the grade standards are to be strictly enforced and competition is becoming more keen growers will have to make determined efforts to deal with this insect, the control of which was outlined in the October and December notes.

Packing: The regulations for the standardization of grades of fruit sold on the local markets stipulate that the fruit be properly packed, so that growers who do their own packing should see to it that their work is of the required standard. The pocket pack should be used, and, while practically every one is familiar with this pack, the actual execution of the work is often at fault. One of the most frequent complaints by the buyers is on account of slack packs, which, on arrival at the markets after the handling during transit, give the boxes the appearance of being only partly filled. Packers must take care to see that each subsequent layer of fruit is placed well down into the pocket provided in the layer previously put in. This is important, and is the whole secret of the elimination of slack packs. Another fault which occurs very frequently is the failure to build up a crown pack right from the time of placing in the second layer, with the result that when the pack is finished the fruit is at an even height above the top of the case from end to end. This means that in the process of lidding the fruit at the ends has to be literally squashed into position, with the resultant bruising of quite a number of fruits. If the crown pack is built up from the beginning, the end fruits are only slightly above the boards at the finish while those in the centre are about 1 in. up, the surface from end to end being evenly curved. The bulge required for local market fruit, although distinct, is as a rule below that applied for export fruit.

The method of building up a crown pack is by means of a difference in the depth of the pockets in the first layer, and not, as has often been supposed, by the selection of smaller-diameter fruit for the end positions. When about three-quarters of the first layer has been placed in position the packer should put both hands in the box and draw the fruit slightly towards the packed end. This operation has the effect of tightening up the pockets towards the centre but still leaves those towards the end of a larger size. The remaining few fruits are then put in with wide pockets, and when the second layer has been placed in position the bulge has already commenced. To avoid loose packing, each subsequent layer must go properly down into the pockets available, but the pockets in the middle of the layer, being smaller, do not allow the fruit to go so deeply, thus building the bulge.

To obtain a good pack the fruit should be of uniform size, and while the regulations allow a slight variation to the extent of $\frac{1}{4}$ in. *above* the size branded on the case, it should be noted that no fruit *below* that size may be included. —*A. R. Grainger, Orchard Instructor, Tauranga.*

POULTRY-KEEPING.

Duck-keeping.

It is generally agreed that most of our domestic ducks have descended from the wild or Mallard duck. The most popular breeds in this country at the present time are the Indian Runner, Khaki Campbell, and Pekin. Results from our local egg-laying competitions indicate that good strains of Indian Runners and Khaki Campbells are probably the greatest egg-producers of all species of bird life.

History tells us that Indian Runners were first introduced into England from India about 1840, and owing to their great egg-producing qualities they soon established a local reputation and gradually spread to other countries. The "New Zealand Utility Poultry Standard" sets down the standard weight of Indian Runners as follows: Drakes over twelve months, 5 lb. to $6\frac{1}{2}$ lb.; ducks over twelve months, 4 lb. to $5\frac{1}{2}$ lb. The chief

characteristics of the Runners are their peculiar erect penguin-like carriage and active habits. They were termed " Indian Runners " on account of their peculiar running gait so distinctive from the " waddle " of other breeds.

The Khaki Campbell is a much more recent creation, having been produced in England by a Mrs. Campbell. The Standard sets down the weights for Khaki Campbells as—Drakes over twelve months, 7 lb. to 8½ lb.; ducks over twelve months, 6 lb. to 7½ lb. They are a heavier bird than the Runner, and are regarded as more of a dual-purpose breed.

The Pekins, it is claimed, were first imported into England and America from Pekin about 1873. They differ from other breeds in the shape of the body, having a singular turned-up carriage of the tail, the type suggesting that of an Indian canoe. The Standard weights are—Drakes over twelve months, 8 lb. to 9½ lb.; ducks over twelve months, 7 lb. to 8½ lb. The Pekins, which are more-or-less non-sitters, are well adapted for fattening in confinement, their flesh is very succulent, and if bred systematically for egg-production they prove very prolific layers.

Where suitable environment is available, quite a few people in New Zealand could add to their incomes by keeping a flock of well-bred ducks. While small flocks of ducks have been kept profitably in confined runs, and even when run with hens a few ducks have at times given good results, it is not a good plan to run ducks and fowls together, for if this is done it is almost impossible to keep the yards, especially round the drinking-vessels, in a sanitary condition. Hens and ducks should have separate yards.

For egg-production a good free range is ideal, and on many farms where a suitable range is available a flock of good ducks should prove a good investment. Ducks do well in an orchard, where they destroy many slugs and insects, and benefit from the shade from the trees. On an ideal free range some flocks of ducks are given only one good feed a day during certain months of the year (from about September to January), and that is given in the evening in order to encourage them to return home to their yards. As ducks lay their eggs at night or early in the morning they should be kept in their yards till 9 or 10 o'clock in the morning, otherwise many eggs are likely to be lost.

While a flock of ducks can be kept profitably if suitable environment is available, it is advisable to bear in mind that duck-farming on a large scale is a highly specialized business, which calls for considerable practical experience. The person wishing to undertake duck-culture would be wise to start in a small way, and if the work is found agreeable and a payable market is available for all produce to gradually expand the work as knowledge grows.

Housing and Yards.

Ducks do not require expensive houses; in fact, in many parts of New Zealand no houses are needed, provided the birds have shelter from cold winds, bad weather, and shade from the hot sun. Although they like to forage in damp places ducks should have a dry camping-ground, and if sheds or shelters are erected and the birds shut in at night the essentials to keep in mind are plenty of fresh air, dry floors, and protection against rats. It is advisable to provide plenty of open space, and to cover the front of the house with wire netting. Each duck should be allowed at least 6 square feet of floor-space. It is well to have space enough for two yards, even if the yard is only used at night, for ducks soon taint a small yard. A netting fence, 3 ft. high, serves to keep ducks enclosed, and if stakes are placed just far enough apart to hold up the netting, such fences can be shifted easily when the ground gets stale.

As ducks are inclined to be nervous and timid, it is advisable to select a quiet secluded place for their yards. For instance, cases have come under

notice where motor-car lights have disturbed ducks at night, with the result that they gave very poor returns. In order to get the best results they must have quietness, especially at night.

Feeding.

As ducks have no crops, like fowls, the food passes directly to the gizzard. Therefore food best suited for ducks is that which is soft and easily digested. Another point to bear in mind when feeding ducks is that their digestive organs work quickly, and the food they eat has a big influence on the flavour of their eggs. For this reason care should be taken to see that the food they eat is fresh and free from any strong flavour. If care is taken regarding this matter and the eggs are collected early in the morning and not left in the sun or in muddy yards, there would be much less prejudice against the strong flavour of duck-eggs. While ducks fed for egg-production should be well provided for, care must be taken to see that no feed is left to get sour, and it is necessary that they should be fed in troughs or shallow boxes, A good style of duck-feeding trough is shown on page 78 of this Department's publication " Utility Poultry-keeping."

Feeding Laying Ducks.

Most duck-keepers have their own particular system of feeding, and know from experience that it is very unwise to make any change, especially when ducks are in profit.

When ducks have a good range where plenty of animal food and succulent green food is available, they can be given a light feed in the morning before being let out, and a good full feed at night. A suitable plain mixture may consist of two measures of pollard, one measure of bran, and from 5 per cent. to 10 per cent. of meat-meal, according to the season of the year, more animal food to be given during the autumn and winter. The mixture should be given in a crumbly state.

Where ducks are more or less confined, it should be remembered that their food, if on a good free range, consists largely of worms, grubs, insects, and succulent green food, so in order to get the best production from ducks in confinement their food must consist largely of succulent greens and animal food.

A suitable mixture for ducks kept in small yards may consist of 2 measures pollard, 1 measure bran, 1 measure finely cut green or boiled vegetables, and 1 measure of meat-meal, the whole mixed with water or skim-milk into a crumbly state. A regular supply of succulent green food should also be given each day.

Grit and Oyster-shell.

Grit and oyster-shell are even more important for ducks than hens, and a liberal supply of both these essentials should be always within reach of the birds. Even ducks on free range should have a box of grit placed near their camping-grounds or shelters.

Water for Ducks.

Though it is not essential for such breeds as Runners or Khaki Campbells to have water to swim in, better fertility is obtained if they have a pond available. Moreover, ducks consume more water than any other birds, and a supply should be before them at all times. The water-vessels for ducks should be deep enough to enable them to cover their heads and wash their eyes and nostrils when drinking.

Each year many young ducklings are lost with staggers and apoplexy, because a good supply of drinking-water is not constantly before them.

If it is found that the water receptacles are empty when one goes to feed young ducklings, it is advisable to give them a drink first and delay the feeding till after they have had a drink.

Further notes on duck-keeping will be published in next issue.

—C. J. C. Cussen, Chief Poultry Instructor, Wellington.

THE APIARY.

Moving of Bees.

At this season of the year bees may be moved to a new location with perfect safety. If the work is left until spring, when the activities of the hive commence, the resultant loss of field-bees is enormous. More especially should advantage be taken of the bees' dormant condition if the hives are to be moved short distances only. The colonies are numerically weaker, and there is usually little brood to become injured in transport. When hives are located for any length of time in one position, the flying bees take full observation of every landmark, but as in the winter there are shorter periods of sunshine the flight of the bees is necessarily curtailed, and they usually return at a much shorter distance from the hive. In addition, there are often periods of several days together during which they take no flight at all, and in consequence they must renew their acquaintance with their surroundings when an opportunity for flight occurs. Therefore, if the hives are moved during a spell of bad weather, the bees will take more readily to their new location when a fine day comes. Any bee-shifting operations should be completed before the end of July.

To secure bees for transit over a short distance sufficient ventilation can be provided by tacking a piece of wire gauze over the hive-entrance. It is then necessary to secure only the bottom and roof, and, after making sure that there are no holes through which the bees can escape, the hive may be carried with safety.

The successful moving of bees over long distances calls for considerable preparation. All heavy combs should be secured, and only sufficient honey left in the hives to prevent the bees from starving during their journey. The most important factor is ventilation, and neglect of this matter leads, as a rule, to heavy losses when bees are being moved. The constant vibration of any vehicle tends to disturb the cluster, and the excitement caused thereby is sufficient to raise the temperature of the hive considerably, so that the bees are in danger of being suffocated and the brood scalded. These troubles can be avoided by the employment of wire screens. It is advisable first to see that the frames are made as secure as possible by inserting two wedges between the side of the hive and the top of the end frames. This prevents the frames from rocking during transit. The bottom-board should then be secured to the hive-body by means of crate-staples, driving one end of the staple into the hive-body and the other into the bottom-board. Usually six staples are sufficient. The screens can be made by using narrow laths nailed together to form a frame of the same dimensions as the hive-body, and covering this with wire cloth such as is used for making queen-cages. The screens must be fastened securely to the top of the hive and the entrance covered with wire cloth. By this means ample ventilation is provided to ensure the safe carriage of the bees during the winter months.

In these days of motor transport the work of moving bees over long distances is greatly minimized, and the beekeeper should adopt this method if he can. In any case, the beekeeper who has occasion to move bees should not relax any effort to make the hives secure when moving to a new location.

Condition of Hive-mats.

At intervals during the winter months the mats should be examined to note their condition. After heavy rain the mats are liable to become damp: damp mats should be removed and dry ones substituted. To save delay a supply of dry mats should always be kept on hand. It is advisable, as far as possible, not to disturb the colonies when making an examination, and especially to avoid jarring the hives. The roof can be carefully lifted and the mat examined. If the latter has to be removed the smoker should be handy in case the bees are troublesome, but it should not be used unless the bees have to be driven down. It is advisable to remove the wet mat as speedily as possible, replace it with a dry one, and cover the hive.

Leaky Covers.

Damp mats usually point to defects in the covers, and it should be worth the beekeeper's while to remove these also. At all seasons the comfort of the bees should be one of the main considerations, and this matter cannot be ignored if successful wintering is to be expected. The labour involved in keeping the hives watertight repays their owner many times over, and prevents to a large extent the loss of heat generated by the bees. One should aim at reducing the waste of energy of the bees by maintaining the heat of the cluster at an even temperature during the unproductive season, and this is impossible where leaky roofs are tolerated. Successful wintering is a high test of the beekeeper's capabilities.

Permanent Shelter.

Now that the actual work of the apiary is off the beekeeper's hands for a while, he may devote his attention to the matter of providing permanent shelter for the hives. If he has definitely decided on a permanent location for the apiary, he should now set about the cultivation of a quick-growing hedge. This matter is a most important one, and ranks next to that of locality. It is noticeable in sheltered situations that the bees are able to take cleansing flights during the mild days of winter, whereas bees in unsheltered positions are often confined to their hives even on sunny days. An occasional flight in the winter is as necessary for the welfare of the bees as any other provision the beekeeper can make for their comfort.

Whatever shrubs or trees are provided for the purpose of producing a permanent hedge, they should be planted thickly, and trimmed to produce abundant foliage, especially at the base. It is highly important that the plants stand cutting-back, so that the hedge can be kept at a reasonable height. Hedges grown to a height of 8 ft. to 10 ft., and no higher, provide ample shelter for a large apiary. There is also less trouble in taking swarms if the trees are kept to the height indicated. Locality and situation must to a large extent influence the beekeeper in choosing the most suitable plants, but, whatever the hedge, the purpose should be to form thick shelter and not a plantation.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Some Soil Pests.

WHERE humus is abundant and tender seedlings are plentiful, a hungry host of insects will often be found feeding upon them unless steps are taken to study the creatures and check their depredations before they become excessive. In shaded moist positions they will be chiefly slugs and snails: in warm sheltered places the crustaceans known as slaters or wood lice are most plentiful. In the more open spaces a dark stout caterpillar, commonly known as a cutworm, the larva of one of the larger heavy-flying

summer moths, lies dormant in the soil during the day, but does an enormous amount of harm at night feeding on the roots of young plants, or even cutting them down completely just at the surface of the ground. While small and tender the seedlings are easily injured, and the cause of their slow growth or total disappearance is often unsuspected, so closely hidden are their enemies during the day. Inspection with a torch at night reveals these usually sluggish creatures in a state of great activity, which is a contrast to their behaviour during the hours of daylight. Some protection is often required to enable the crop to grow away quickly or even prevent its total destruction.

Bluestone in any form is most effective in destroying slugs; 18 lb. finely ground and mixed with 3 cwt. kainit or other fertilizer per acre will afford protection. Powdered alum is also a powerful deterrent; or a solution, ½ lb. to a gallon of water, may be sprayed after sundown when the pest is active. The powdered alum mixed with twice its weight of lime and applied at a rate of ½ cwt. per acre is most economical.

For this and other pests mentioned above the most generally useful dressing is a bait composed of 1 lb. paris green and 28 lb. bran thoroughly mixed in a dry state. It is then made into a flakey mash with water and broadcasted towards evening, when the insects become active. Arsenate of lead powder, 2 lb., may be used in the place of paris green. This quantity is sufficient for an acre. It is best applied when the land is fallow, a few days before sowing or planting.

Good reports have been received of a new slugicide made of one pint of bran mixed with one "meta" tablet finely ground. These tablets, used for heating, are composed of metaldehyde and obtainable from chemists. They are not soluble in water. The remedy is useful in home gardens where a poison bait may be objectionable.

Vegetable Crops.

It is usually towards the end of the month of July before much can be done with annual vegetable crops. On sheltered light land, and elsewhere where it is warm, a commencement may be made by planting out shallots, garlic, cabbage, and cauliflower; also sowing early peas, spinach, and salads. Of the perennial crops, rhubarb may then be planted, but asparagus is best left until the following month.

Of all the factors contributing to a good crop, the application of artificial fertilizers is one which receives considerable attention. This powerful aid to good cropping requires very nice adjustment to obtain the best results. It is not merely a question of obtaining a chemical analysis of the soil and making good the deficiencies by use of chemical fertilizers; the heavier dressings of fertilizers are often applied to the richest land. The results of high feeding may be heavy crops, exceptional quality, or serious loss from disease, the latter usually occurring when the application is badly balanced as to its ingredients, the application is badly timed, or may be unsuited to the soil or the crops. Extremely heavy applications of fertilizers are to some extent a gamble, and they should be made only by those with a long experience of a locality. The result depends very largely on the weather experienced after the application is made. Under most circumstances it is best to apply a moderate dressing before sowing and planting, and side dressings afterwards as may be required; then if the drainage is good and the lime requirement of the soil is watched the best results from the fertilizers may be expected.

The kind and quantity of fertilizers to be used with each crop must be carefully adjusted after considering all the circumstances. For crops of the

cabbage family 3 cwt. to 6 cwt. of superphosphate and 1½ cwt. to 3 cwt. of sulphate of potash worked into the land before planting will often be satisfactory where a good dressing of farm manure has been turned under in the preliminary preparation. Where farm or stable manure has not been used, half a ton or so of blood and bone or fish manure should be incorporated during the preparation of the land. If 1 cwt. or 2 cwt. of nitrate of soda are applied as a side dressing when the plants are established and this is repeated when they commence to heart up it will often be found satisfactory. Somewhat similar treatment is suitable for salad crops. Where the land is heavy 1 cwt. or 2 cwt. of sulphate of ammonia may be included in the dressing before planting and the first dressing of nitrate of soda omitted. Culinary peas, like most other crops which are required to flower and seed, do not require so much nitrogen as the preceding. Where the land is in good heart from previous dressings the superphosphate and potash quantities mentioned above will probably meet their requirements. In preparing land for rhubarb a heavy dressing of farm manure is turned under and 3 cwt. to 6 cwt. superphosphate per acre is worked in before planting.

Small and Sundry Fruits.

In the warmer districts the tomato crop under glass is planted out towards the end of July—in middle districts about the end of August. During recent years it has been necessary to stress the damage caused by the excessive use of stable manure before planting out this crop. The danger is greatest where the water-table in the subsoil is comparatively high, or where the land is heavy and drainage is inclined to be defective. It is, however, necessary, to maintain fertility, to keep up a supply of humus in the soil by means of stable manure or cover-crops. The need will specially require to be watched where the subsoil is open and where steam sterilization of the soil is practised. In preparation for planting a dressing of artificial fertilizers should be worked in two or three weeks previously. In the absence of local data the following moderate dressing may be used to the square yard: ¼ lb. bonedust, 2 oz. superphosphate, and 2 oz. sulphate of potash.

In preparing the tomato-plants for setting out it will generally be advisable to fumigate them with nicotine to destroy aphides. Insect infestation is generally the main cause of virus disease in this crop under glass, and treatment is more easily given before than after planting out.

Planting-distances are important; they should be widest in warm humid localities especially where ventilating facilities are limited, as is so often the case. Under such circumstances 12 in. between plants and 30 in. between rows will not be excessive, but in any case the rows should not be closer than 24 in. to obtain the best results.

About the month of July, as autumn-planted strawberries commence to make growth, a small dressing of blood and bone manure worked into the ground between the rows will usually be beneficial; a little superphosphate may be included if desirable; established beds may be given a similar dressing. Two or three such dressings at intervals will build up the plants for heavy cropping. In at least one dressing 1 cwt. per acre of sulphate of potash should be included in the mixture.

The quality and demand for persimmons, Cape gooseberries, and tree tomatoes on the market at the present time suggest that more attention might be given to the production of these and other kinds of fruit that are not usually grown. It is evident we have not fully realized the possibilities of the resources we have in the land and climate of New Zealand, especially in the warmer sheltered localities. Avocados, feijoa, and figs are also produced in excellent varieties and quality, and planting might well be

extended where they are doing well. Up to the present avocados have borne fair crops in the Gisborne district only, and some pioneer work still remains to be done, more particularly in the matter of variety trials. It is a very wholesome fruit and when the public have acquired the taste it should be in good demand. This is the planting-season, and consideration might be given a practical turn by making arrangements for planting during the months of August and September, if only a few trees, of this class as an experiment.

The Homestead Garden.

Where new gardens are being made the formation should be pushed ahead as weather permits, so that it may have time to consolidate before sowing down the lawns during the months of August and September. It is important that the surface should be at the right height, that it should be smooth, that the grade should fall away from the dwelling, and all surface water properly accommodated. These points should be verified positively before sowing the seed. An alternative method is to make new lawns by laying turfs. For small gardens where the area of the lawn is limited this method is very suitable ; also in making minor alterations in an established garden, as when turfing-down old borders or making new beds. Worn patches in a lawn, about the centre or verge, are best repaired by turfing—in mild weather when the land is sufficiently dry.

Consideration should now be given to the pruning requirements of plantations, shrubberies, and climbing plants. In many parts of the country trees mutilated by careless pruning are an unpleasant spectacle, and their value as timber or for shelter purposes is seriously discounted. With systematic attention there should rarely be a necessity to remove large limbs : where it does occur the cut should be clean and flush with the trunk, or just beyond a good lateral growth. To do this a sharp saw is required and an under-cut should be made first, so that when the limb is severed from above it will fall without ripping the bark. If Stockholm tar or a thick paint is then applied to keep out moisture and decay, the tree will be preserved, and also its appearance and usefulness so far as possible.

The necessity of such major operations arises through encroachment or congestion, and when examining trees and shrubs now such developments should be prevented by the timely removal of the branches causing it while they are comparatively small. Congestion or crowding of the branches, especially about the centre or the base of hardwood plants, is unsatisfactory and should be given attention from the commencement when the plants are first set out.

Where, in addition to this, pruning is done to encourage the production of flowers, and possibly fruit, the habit of the plant must be more closely studied to ascertain, for instance, whether the flowers are produced on new wood, as in the case of roses, bougainvillea, and so many others ; or on young wood that is of last season's growth, as in peach and weigela ; or on spurs on the old wood, as in apple and wistaria. The shrubs and climbers grown for blossom should be closely studied from this point of view while at the same time realizing that such subjects usually require rather generous feeding to enable them to maintain the display.

In most plantations and shrubberies the annual mulching of leaves which fall from the trees in autumn or spring is sufficient to feed the roots, but in the case of the more ornamental sections, where much blossom is expected, a dressing of bonemeal and well-decayed farm manure will be of great assistance. This should be worked in by means of shallow cultivation, as any serious disturbance of the roots is injurious.

—W. C. Hyde, Horticulturist, Wellington.

SEED-WHEAT CERTIFICATION.

FOLLOWING is a list of growers for the month of May whose wheat crops have passed both the field and grain inspections required under the Government scheme for the certification of seed wheat. The seed from these crops is not recognized as finally certified until it has been satisfactorily machine-dressed and the sacks suitably sealed and tagged. (Previous lists, to which those interested are referred, appeared in the March, April, and May *Journals*) :—

Variety.	Grower.	Acreage.
Cross 7	Anderson, J., Southburn	8
	Boag, P. M., Winchmore, R.M.D.	20
	Borrie, P. W., Waihao Downs	17
	McLeod, J. A., Tycho, R.M.D., Timaru ..	50
	Manchester, J., Waimate	20
	Pearce, B. V., Methven	17
	Symes, O. W., Lyndhurst	25
Dreadnought ..	Austin, K., care of Elderslie Stud, Ltd., P.B., Oamaru	10
	Barnett, A. W. Morven	8
	Daly Bros., St. Andrews	20
Hunter's II ..	Marshall, W. J., Gleniti, Timaru	13
Solid Straw Tuscan	Brophy, J., Pleasant Valley	12

—*Fields Division.*

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 6th May, 1937, to 3rd June, 1937, include the following of agricultural interest :—

No. 75679 : Spraying-gun ; R. A. Snelgrove. No. 75972 : Wool-dusting machine ; F. Young and Co., Ltd. No. 76512 : Manure ; E. C. Nuske. No. 76051 : Milking-machine ; New Zealand Express Co., Ltd. No. 76153 : Milking-machine ; F. A. Stempa. No. 76379 : Weed-killer ; Chipman Chemical Co., Ltd. No. 76810 : Fencing-post ; H. W. James. No. 77368 : Sheep-shearing-machine hand-piece ; Wolseley Sheep Shearing Machine Co., Ltd. No. 75282 : Ice-cream machine ; H. Sandlant. No. 76445 : Holding cow's tail during milking ; J. W. Baxter. No. 76639 : Fruit-mixing apparatus ; Barron-Gray Packing Co. No. 76729 : Spray-pump ; R. L. W. Robinson. No. 77370 : Milk-measuring means.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price, 1s. prepaid.

DEPARTMENT OF AGRICULTURE.
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WEATHER RECORDS: MAY, 1937.

Dominion Meteorological Office.

NOTES FOR MAY.

THOUGH not particularly severe, the first part of May was cold and rather stormy. After the first week there was rather more snow than usual on the mountains. From then onwards mild weather prevailed, the conditions in the last twelve days often being almost summer-like. Rainfall was above average in most districts, and especially so over most of the South Island and the Auckland Province. The sky was cloudy and the atmosphere humid, so that even where the rain was below average moist conditions prevailed. This state of affairs was accentuated by the absence of wind during the second half of the month. Grass has continued to grow, so that there is everywhere abundant feed for stock, which are reported generally to be in good condition. The state of the pastures has been very favourable to the dairying industry, but less so for fattening stock. In the North the somewhat stormy conditions and the lack of sunshine caused the growth of most vegetation to be checked, but in the rest of the country growth was unusually vigorous for the time of year. Numbers of trees and shrubs are flowering out of season. The ground is in most districts too soft for ploughing and the sowing of crops.

Rainfall.—In the North Island the total rainfall was considerably above average from Auckland northwards and in parts of the Bay of Plenty and central areas and the South Taranaki Bight. East of the main ranges, in western Taranaki, and in southern Wellington, it was below average. Over the South Island the month was a wet one, except about the Canterbury-Marlborough border and in the extreme South.

Temperatures were about normal in Nelson, Marlborough, and North Canterbury, but above it almost everywhere else. The departures, except at some inland stations, were generally less than a degree. There was some cold weather in the first week, but thereafter, and especially after the 19th, it was very mild. There were few frosts, and none very severe.

Sunshine was much below average in the North Island, especially the northern portion. Christchurch and Hanmer Springs reported slightly more than average, but elsewhere in the South Island also there was less than normal. Blenheim had 147·5 hours, Napier 143·3, and Wanganui 142·5.

Pressure Systems.—During the first four days the westerly type of weather prevailed, strong winds blowing from between north-west and south-west, with frequent rain in districts with a westerly aspect, and some snow and hail on the ranges. During the 4th, conditions became particularly boisterous, with widespread westerly gales. Severe thunderstorms occurred in many places west of the ranges, hailstorms were numerous, and heavy snow fell on the ranges.

After a brief spell of anticyclonic weather another westerly depression brought north-west to westerly gales to many places on the 8th to 9th. Some heavy rains were recorded, especially in the ranges.

On the 11th an anticyclone moved on to the Dominion, and fine weather prevailed. By the 13th the anticyclone was centered to the eastward, and had become rather intense. Strong north-easterly winds set in over the northern part of the North Island. A cyclone gradually formed near Norfolk Island, and travelled southward across New Zealand before dying out on the 17th. It was responsible for dull and misty conditions and widespread rain.

Depressions of minor intensity passing on the 19th and 23rd brought heavy rain to a few districts, and a shallow cyclone centred to the west caused rather stormy weather in North Auckland on the 27th. Generally speaking, however, quiet conditions prevailed from the 17th onwards.

RAINFALLS FOR MAY, 1937, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Fall.	Total Rainfall to Date.	Average Rainfall to Date.
	North Island.					
	Inches.		Inches.	Inches.	Inches.	Inches.
Kaitaia	7·06	19	1·75	6·61	28·76	21·57
Russell	14·09	17	4·20	7·09	43·29	23·95
Whangarei	9·16	19	2·34	7·88	33·36	25·06
Auckland	7·04	23	1·48	5·15	18·74	18·84
Hamilton	7·09	18	1·60	4·70	20·73	18·79
Rotorua	8·98	15	3·30	5·69	25·79	21·62
Kawhia	4·92	15	0·77	5·34	17·61	19·82
New Plymouth ..	4·72	18	0·90	6·20	26·16	22·59
Riversdale, Inglewood ..	10·16	16	2·29	9·69	45·61	38·38
Whangamomona ..	10·54	12	2·10	6·84	34·83	27·81
Hawera	3·37	17	0·63	4·58	19·57	16·98
Tairua	5·41	21	0·94	7·08	22·22	26·59
Tauranga	5·22	15	1·03	5·10	25·28	21·53
Maraehako Station, Opotiki	7·51	11	2·75	5·70	28·73	22·13
Gisborne	1·70	8	0·68	5·36	13·87	20·01
Taupo	4·83	16	1·53	3·95	16·20	16·80
Napier	1·34	9	0·44	3·18	8·59	13·16
Hastings	1·08	10	0·56	3·29	5·74	13·56
Whakarara Station ..	..	..	..	..	..	..
Taihape	3·67	18	0·61	3·47	14·82	14·43
Masterton	3·01	14	0·94	4·04	13·04	15·18
Patea	4·16	20	0·71	4·15	20·92	17·16
Wanganui	3·89	12	0·90	3·34	17·36	14·33
Foxton	3·15	15	0·50	3·19	12·13	11·88
Wellington	3·41	16	1·10	4·10	15·33	16·58
	South Island.					
Westport	7·13	18	1·27	8·35	39·44	37·65
Greymouth	11·09	20	2·82	8·10	52·14	40·76
Hokitika	10·77	20	2·21	9·58	55·65	45·87
Ross	13·66	17	4·44	9·83	66·61	54·04
Arthur's Pass ..	14·26	14	5·43	12·78	72·46	65·41
Okuru, South Westland	17·42	9	3·00	10·80	76·82	61·32
Collingwood	12·42	16	3·19	8·87	43·96	34·80
Nelson	5·44	16	1·12	3·26	17·36	14·81
Spring Creek, Blenheim	4·50	13	1·70	3·03	13·39	11·53
Seddon	4·02	12	1·59	2·83	11·46	10·23
Hanmer Springs ..	3·08	14	0·80	4·54	12·66	18·38
Highfield, Waiau ..	1·86	8	0·49	3·25	8·19	14·27
Gore Bay	4·84	10	1·64	3·41	13·14	13·18
Christchurch	2·94	..	0·75	2·62	10·08	10·10
Timaru	2·37	14	0·39	1·48	12·27	9·39
Lambrook Station, Fairlie	1·97	11	0·77	1·57	10·81	10·12
Benmore Station, Clearburn	2·40	15	0·57	1·79	15·34	10·99
Oamaru	2·10	11	0·64	1·60	9·19	9·00
Queenstown	3·33	15	0·71	2·59	16·18	13·13
Clyde	2·00	10	0·49	0·99	9·90	6·84
Dunedin	4·33	15	1·02	3·15	23·32	14·94
Wendon	3·27	15	0·84	1·98	25·64	12·89
Balclutha	2·96	16	0·66	1·92	19·48	10·72
Invercargill	3·69	24	0·52	4·36	21·93	19·67
Puysegur Point ..	5·45	23	0·88	6·67	42·28	35·67
Half-moon Bay ..	4·54	19	9·70	4·85	29·22	24·22